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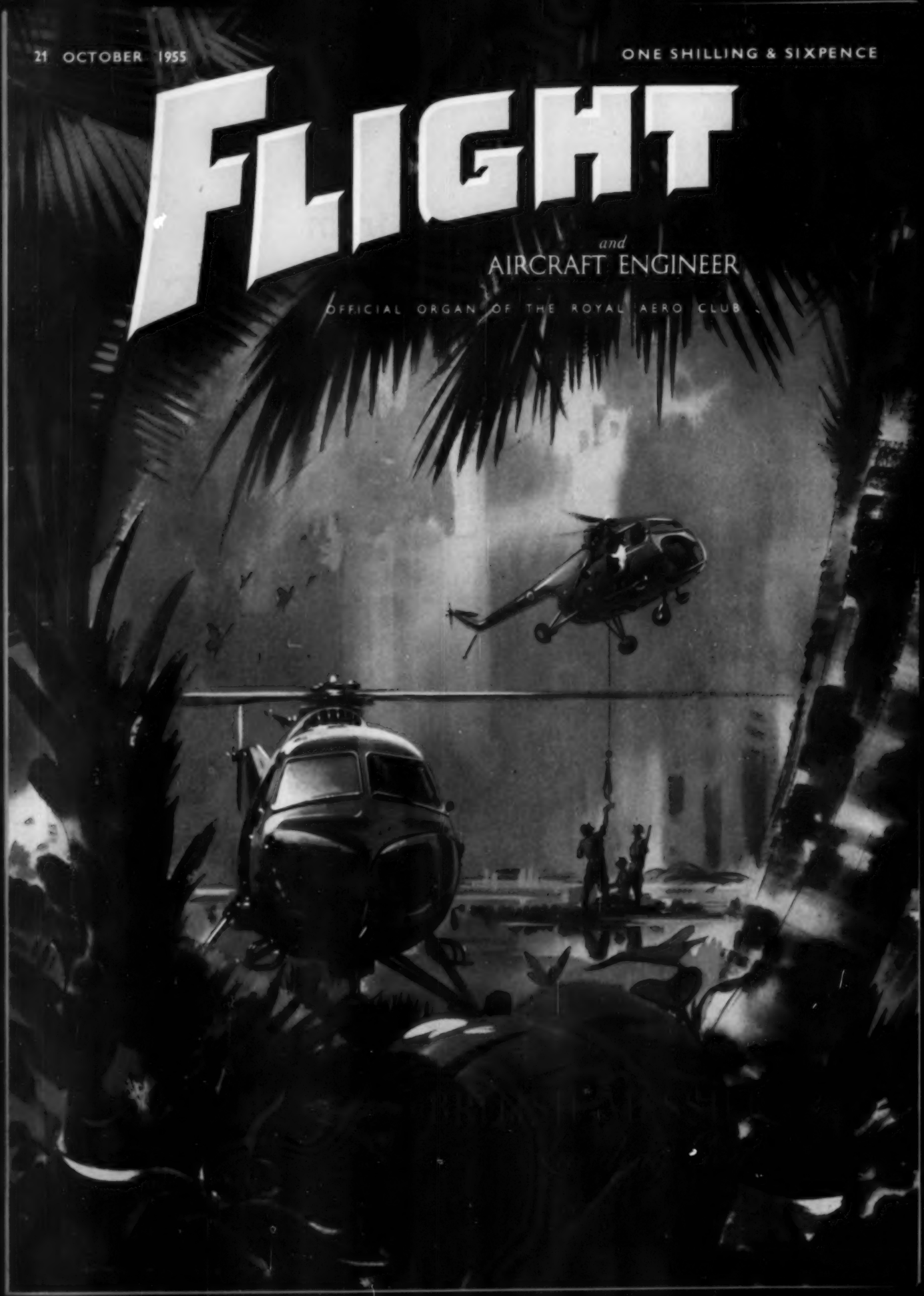

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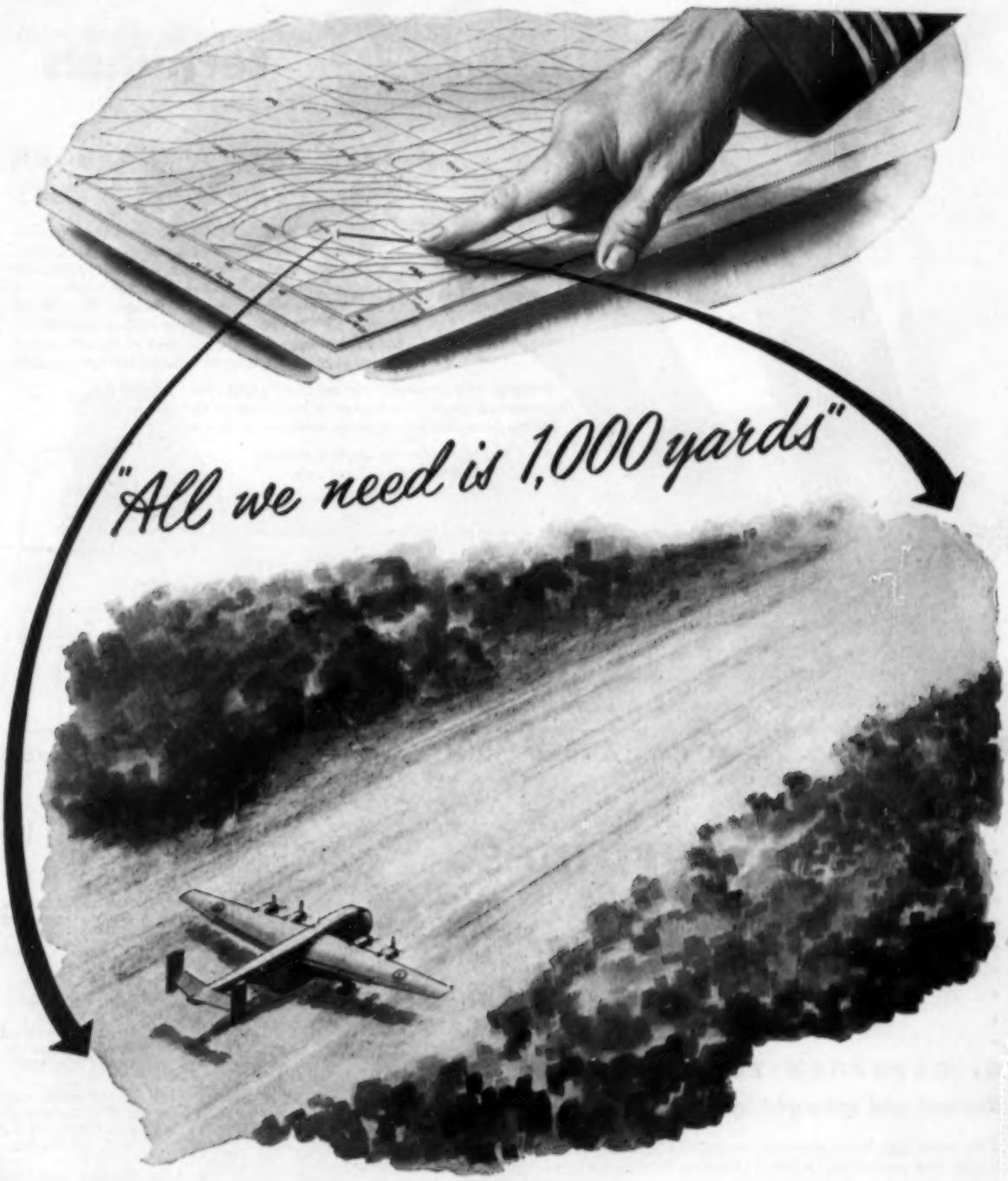

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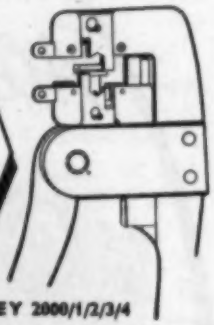

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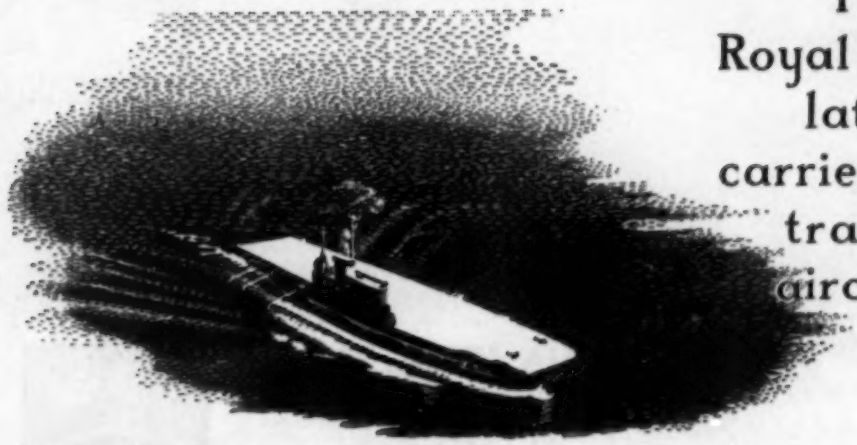

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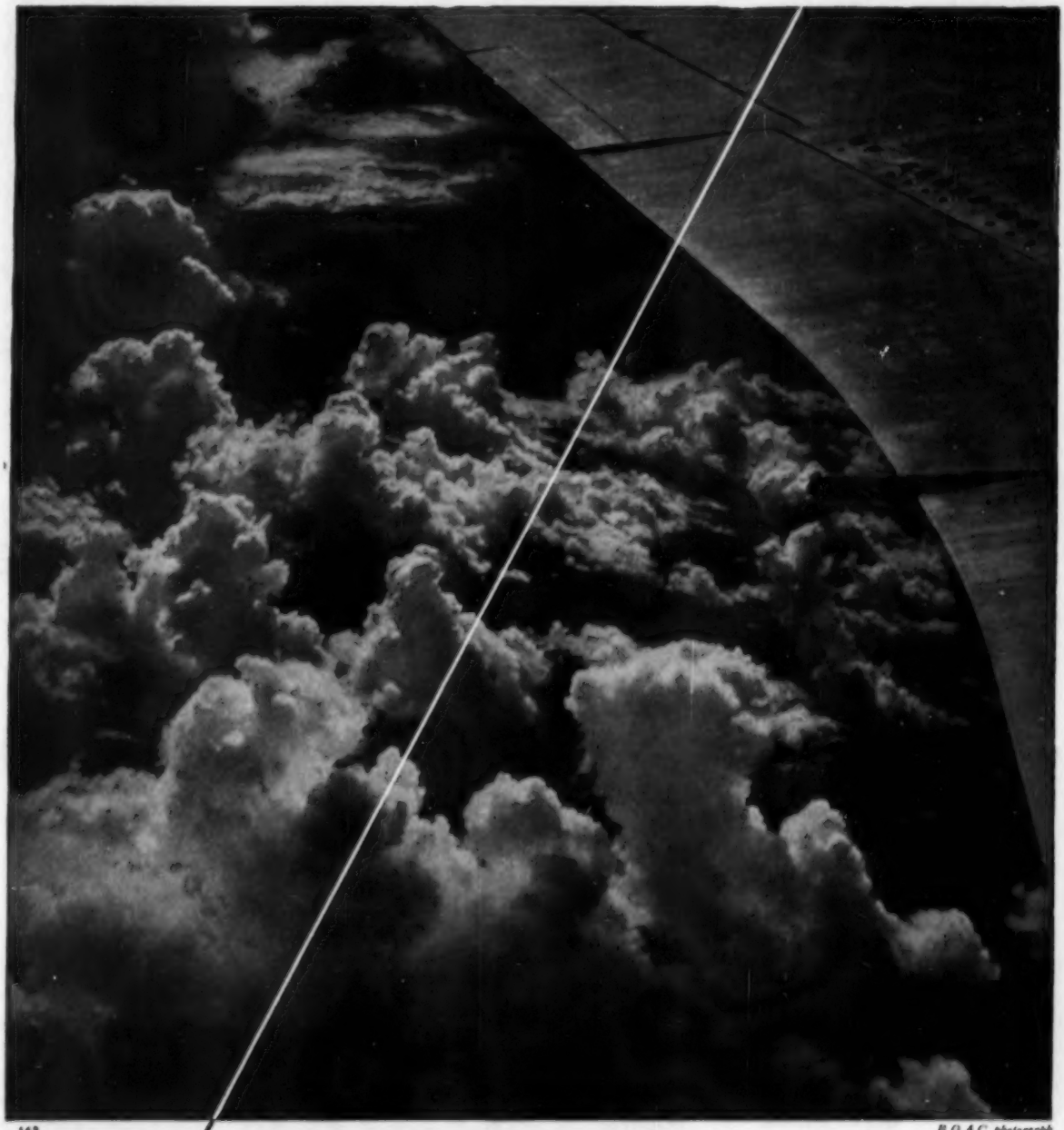

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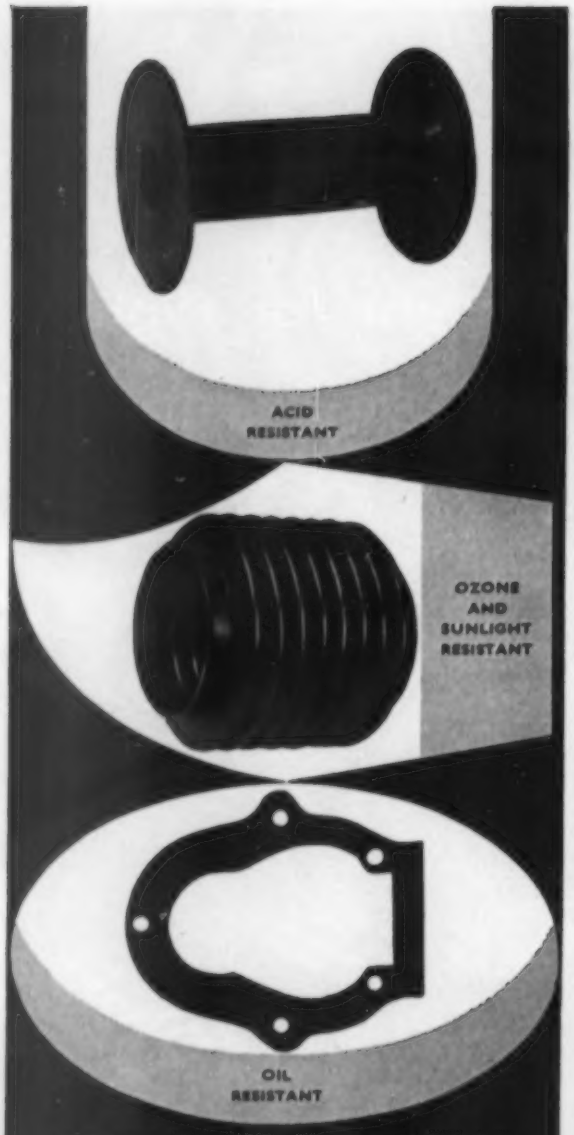

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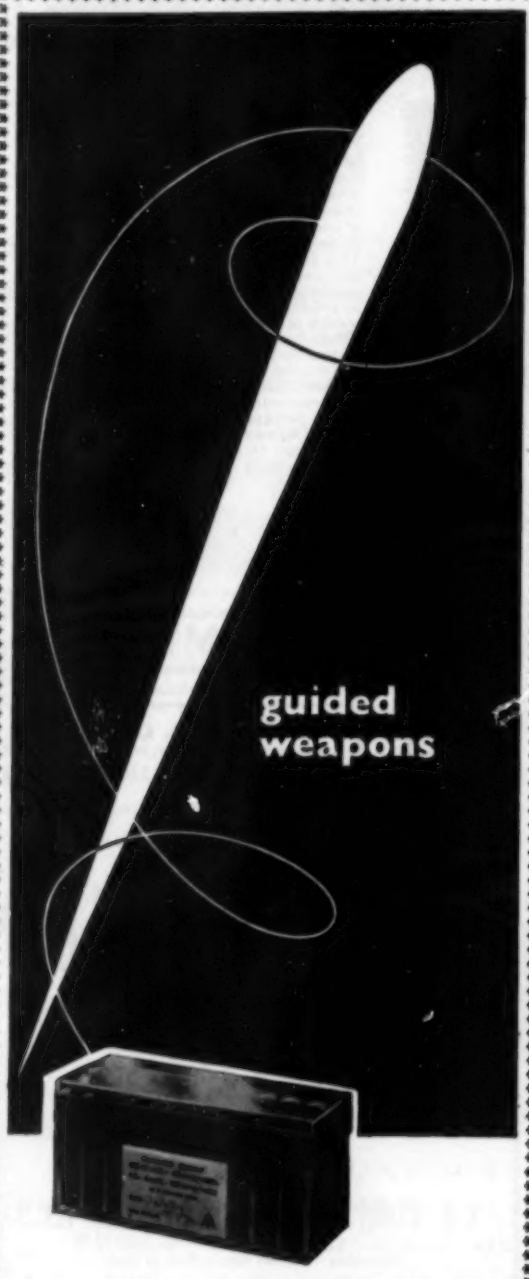

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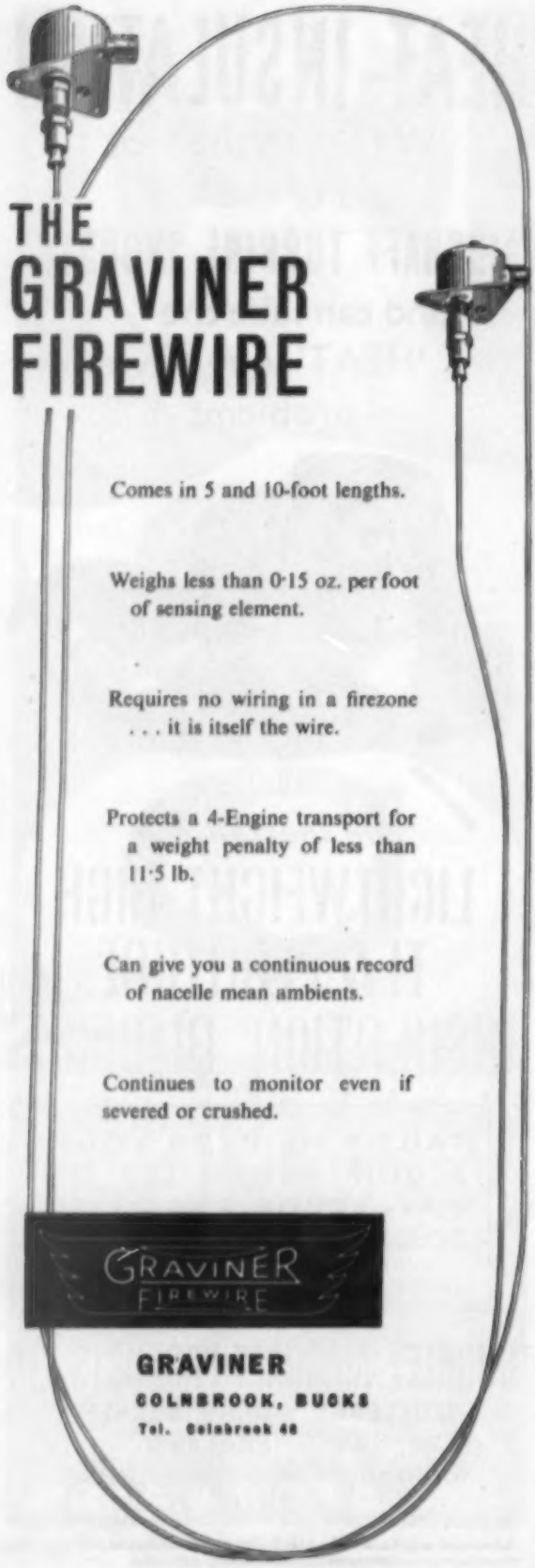

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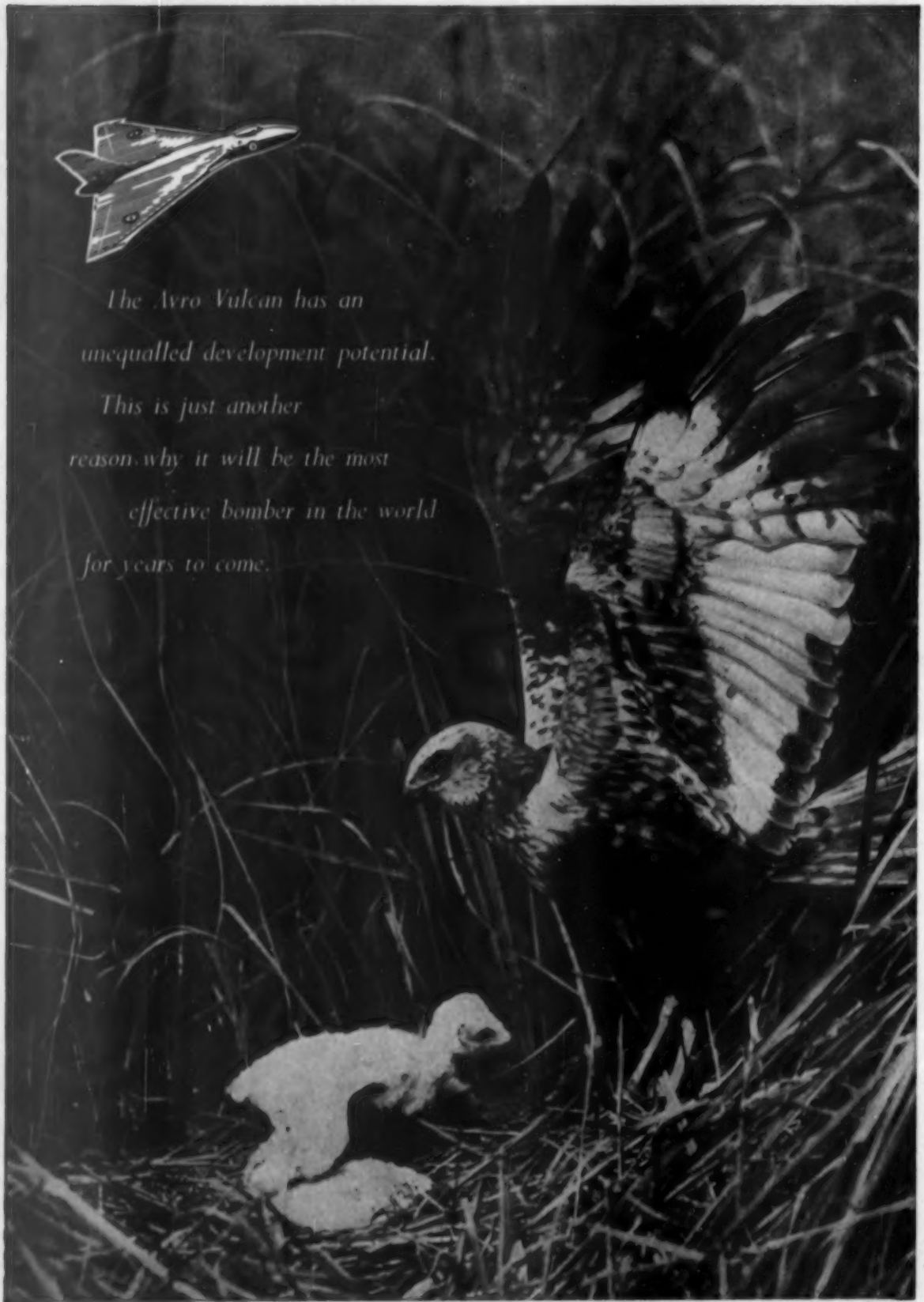
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Marsh Harrier photographed by Eric Hosking. Taken by high-speed flash with a specially constructed set giving 680 joules with two lamps at an exposure of 1/5,000 sec. at f/4·5.

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A Die is Cast

WITH electrifying suddenness the future of mercantile air transport has been largely revealed. In the space of a few days vast patterns have been sealed, and astronomical sums of money apportioned, enabling answers to be given to questions which have perplexed the air transport industry for ten years past.

Least predictable during that period have been characteristics, rôles and economics of pure-jet transports, a class so far removed from convention that their introduction by B.O.A.C. in 1952 called forth much sly banter, as well as acclaim, from abroad. Against the new £96 million Pan American orders for 45 Douglas DC-8s and Boeing 707s, and proposed orders by other lines involving 50-odd machines of the same types, must be set the 20 Comet 4s now building for the Corporation which pioneered the era of jet transport.

Paradoxically, the Vickers 1000 being an uncertain starter, Britain's own contender on the transatlantic run (for which many of the PanAm jets are, of course, intended) is likely to be the turboprop Britannia. But how this excellent machine may fare in the international market, wherein Air France, K.L.M. and S.A.S., among others, are already appraising the American pure-jets, remains a matter for conjecture.

The Comet 4, it must be recognized, is not directly comparable or competitive with either the Boeing or Douglas, being of shorter range, slower and less capacious. But it will cost about half as much, will use less fuel, and will have behind it an unprecedented accumulation of static testing and air experience. The belief is held by de Havillands that PanAm might well select the Comet 4 for those of their routes for which the new American airliners are too large—a belief which is backed by PanAm's own declaration of a "continuing interest" in the D.H. jet programme, and of the hope for a successful outcome from "present confidential understandings." Guarded as these pronouncements are, they refute a published assertion that PanAm's new move means "that the company's contract to buy British Comets has fallen through."

Deliveries of the British and American machines should be under way at about the same time—that is, three years hence. A period which in itself is a measure of the tasks ahead.

Minor Mercies, Major Hopes

Implicit in the momentous swing towards pure-jet transports for the trunk routes is the possibility of good business for British engine-makers, specifically for Rolls-Royce, whose unrivalled by-pass Conway has been engaging the most earnest attention of both Boeing and Douglas. And in this connection we may be thankful for America's firm faith in the podding of jets, an arrangement which affords an exceptional measure of powerplant interchangeability.

We must, indeed, be thankful for any mercy in a world wherein business which might well have come our way continues to pass instead to rivals, worthy as they may be. Which reflection is prompted by the £70 million orders and options by American Airlines and Eastern Airlines for 105 Lockheed Electras, this type being a medium-range turboprop machine of the class pioneered by the Viscount. So to the Viscount and its successors our attention is logically directed: and here the scene is brightened by the new developments described on pages 638 and 650.

In itself a matter for congratulation, especially to Rolls-Royce, is the raising of the Viscount's cruising speed to over 360 m.p.h.; and it is once again an RR-VA team which will give us the Vanguard, a shining new champion in the medium-range field. Bigger and, we may confidently suppose, better than the Electra, the Vanguard appears to be a pre-stretched design; that is, one which is unlikely to need subjecting to the present linear-development process.

But in this bustling, and in many senses relentless, business of air transport it is becoming daily less prudent to make predictions—this notwithstanding our opening remarks.

FROM ALL QUARTERS

Vanguard and Tyne

ON Monday, October 17th, British European Airways, Vickers-Armstrongs and Rolls-Royce jointly announced the V.900 Vanguard, a completely new machine powered by four Rolls-Royce Tyne turboprops. The design is the outcome of years of close co-operation by the three organizations, and more than 60 studies —"everything but a biplane," as Mr. George Edwards, Vickers Aircraft managing director, put it—preceded the finalizing of the present design. All three firms are certain they have reached the optimum solution to the requirements of B.E.A. for the 1960s, and the Corporation are now working out "a substantial order." Deliveries will be made straight from prototype drawings, beginning in 1960.

Details of the aircraft are published on pages 650-651, and of the Tyne (previously known by the works number RB.109) on pages 638-639. Both have grown up together, and form what is confidently believed to be a world-beating combination. At its initial rating of 4,020 e.h.p. the Tyne can easily handle the Vanguard at slightly over 100,000 lb, and provide a cruising speed of approximately 400 m.p.h. Later it is hoped that considerably more power will be forthcoming, and the next stage of V.900 cruising is placed at 425 m.p.h.—with still higher speeds in prospect. In the later Vanguards, routes with 2,500-mile stages will be capable of operation at almost full payload.

Referred to elsewhere in this issue, the Rolls-Royce Dart RDa.7 provides for a maximum take-off power of no less than 2,105 e.s.h.p. This is rather more than the Viscount (as at present conceived) requires, and the RDa.7 can be derated to some 1,800 h.p. for later Viscounts. Equipped with such an engine, the V.806, a development in the long-fuselage V.800 family, will be able to cruise at some 365 m.p.h.

British European Airways are expected to place an order for 20 V.806s, in addition to their present fleet of 22 V.802s, which will start to be delivered next year. They will thus have an ultimate Viscount fleet of some 70 aircraft.

At the same time, news has been given of a Rolls-Royce Dart even later than the RDa.7, the latter being described on page 638. With the new engine—presumably RDa.8—the present types of Viscount could be developed to cruise at some 400 m.p.h. This hotted up (in more ways than one) Dart will be brought into the Viscount picture when commercial considerations are right; with the Tyne it will make for an unbeatable family of turboprop transports.

In 1958, the erecting-shop space available at Hurn and Weybridge for production of the V.700-800-900 series will be increased from 547,000 to 765,000 sq ft. The ultimate rate of output might be 20 aircraft monthly of all three types, provided that sufficient orders are attracted. To date, Vickers have sold 239 Viscounts, and negotiations now in progress should bring the total to 300, although 500 may well be the ultimate total. It is not yet possible to assess fully the size of the Vanguard's potential market, but Mr. George Edwards, leader of the Vickers design-sales team, tentatively suggests a figure of 175-250 aircraft.

In view of the general healthy trend of Vickers/Rolls-Royce transport development, there seems every reason to expect the Viscount and Vanguard families to dominate many of the world's busiest air routes to an increasing extent. For operators of routes capable of generating sufficient traffic, the Vanguard will be the obvious choice; for routes where a machine with 60 seats is adequate, the 400 m.p.h. Viscount will be hard to beat.

Organization for War

ADDRESSING the Royal United Service Institution on October 12th, Field Marshal Viscount Montgomery, Deputy Supreme Commander, Allied Forces in Europe, said that it was essential to bring the three Services closer together and, if necessary, to combine them into one. The present committee system, he said, should be replaced by a Minister of Defence with real powers of decision and action within the limits of Cabinet policy. The Minister should have a Chief of Staff to the Armed Forces to advise him.

Viscount Montgomery maintained that the dominant factor in global war was air power, which should be organized in the Western Alliance as "one single mighty weapon." The Navies could help to save us from complete disaster after a heavy surprise attack. He disagreed profoundly that the Navy's days were over. Of aircraft carriers he said that there might always be a need for vessels from which to operate aircraft, though with progress in vertical take-off and landings we should aim to design something smaller and cheaper than the present carriers.

U.S.-built Britannias?

REPORTS from Montreal that discussions have been taking place between Bristol, Convair, Canadair and Curtiss Wright about the possibility of building Britannias in the U.S. were confirmed earlier this week by Bristol. Reports referred to a new, thin-wing 500 m.p.h. Britannia powered by Bristol BE.25 turboprops. It is clear that the talks were of an exploratory nature and it is unlikely at this stage that any decisions would have been reached. A Bristol statement said: "The object of the talks was to make an initial study of the possibility of a three-nation collaboration in the production of a derivative of the Britannia to meet foreseen demands for a high-speed turboprop in the 1960s." There is already a licence agreement between the Bristol engine division and Curtiss Wright, while Canadair are engaged in producing a maritime-reconnaissance version of the Britannia for the R.C.A.F., with the designation CL-28.

Going Far South

AN illustration opposite shows one of the two S-51s which, as described on page 658, are going to Grahamland as part of the flying equipment for the survey that Hunting Aerosurveys are making on behalf of the Falkland Islands Dependencies. The photograph emphasizes the point, made on the later page, that landings may sometimes be tricky, owing to the narrow beam—about 30ft—of the expedition ship, *Olaf Sven.*

There is also news of the Canso amphibians which will take part. While the helicopters play an indispensable part as ship-to-shore ferries, and on general communications duties, the amphibians,

***BETWEEN DECKS:** Secured by our representative aboard H.M.S. "Ark Royal" during the visit described on pages 648-649, these pictures are among the few released by the Admiralty showing the hangar accommodation. Especially revealing is the uppermost, wherein Sea Hawks are seen stowed in upper and lower hangars. The lower shows Gannets.*

***THE LANDING NET** on the deck of the survey vessel "Oluf Sven" will provide a comparatively non-skid landing surface at times when the ship is coated with Antarctic ice (see "Going For South"). One of Autair's S-51s is shown making practice approaches.*

manned by British and Canadian crews, will do the actual survey flying. They are being fitted out by Field Aviation Co., Ltd. (another Hunting associate) at Oshawa, Canada, and early next month will fly down the east coast of South America to Port Stanley in the Falkland Islands.

One of the Cansos, which are from the fleet of Kenting Aviation, Ltd., is fitted with a tail-mounted magnetometer for mineral search, in addition to Williamson Eagle IX vertical cameras in the floor of the hull, with a camera drift-and-aiming sight in the nose. F.24 oblique cameras are also being installed. The elderly pair of aircraft have already made mining history throughout Canada in the service of Aeromagnetic Surveys, Ltd., of Toronto.

SK-1 Progress

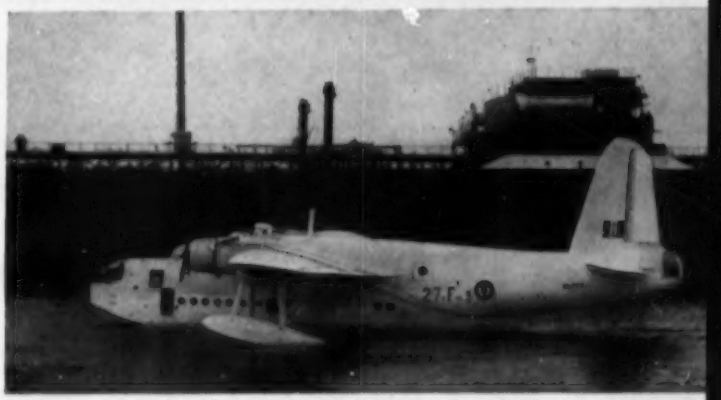
TEST-FLYING of the Somers Kendall SK-1 jet trainer, now painted yellow and registered G-AOBG, is continuing satisfactorily at Woodley, near Reading. Last Friday the aircraft was demonstrated before visitors in a way that showed the confidence which its designer and builder, Mr. Hugh Kendall, already has in it. It took off for its third flight after a commendably short run on bumpy grass and made several fast passes over the field. Both on the ground and in the air handling appeared good. For the landing a tail parachute was used, not for braking but rather to test its functioning. The parachute is designed mainly for spin-recovery during early testing. Streaming is controlled from a grip similar to a hand-brake lever on the stick.

The undercarriage consists of a central mainwheel retracting into the fuselage under the engine, a small rearward-retracting nosewheel which is steerable from the rudder bar, and two wing-tip outrigger wheels with very small solid tyres. These units fold inwards into the wing. Power for retraction is supplied by a compressor bleed from the engine, while extension is by spring and gravity. Forward pressure on the control column applies the mainwheel brake mechanically.

The whole after-fuselage and tail unit is Redux-bonded wood-to-metal, a method which may later be used for the whole airframe. The tail surfaces are all-moving, mass-balanced and fitted with geared unbalancing and trim tabs which provide a centring effect. Static friction is very low. The ailerons are full-span narrow-chord surfaces which can be drooped through a differential linkage to give flap effect. Air brake surfaces are extended mechanically above and below the wing and have so far proved most effective. No more than ten degrees of flap have yet been applied.

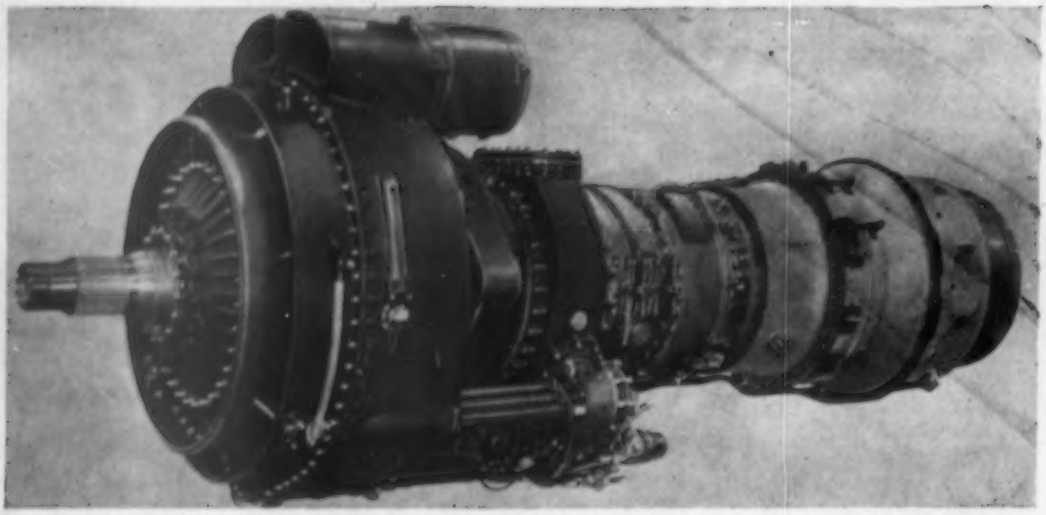
The engine is a Turboméca Palas of 350 lb static thrust aspirated through bifurcated intakes. A total of 360 lb of fuel (44 Imp. gal) is carried in two wing tanks which feed by gravity into a fuselage collector tank. A booster pump and two engine-driven pumps then feed the fuel to the engine. Refuelling is through a single point under the fuselage, at the level of the wing-leading edge. There is accommodation for a lightweight V.H.F. radio and almost the full complement of blind-flying instruments. So far the second pilot's seat has not been installed. The SK-1 had last week completed over an hour's flying with very few snags, and full-scale qualitative and quantitative testing is soon to start. Particularly remarkable in the first machine is the excellence of the workmanship and finish, which are largely the responsibility of Mr. Kendall.

The SK-1 weighs 810 lb empty and 1,500 lb fully loaded. It has a laminar-flow wing with a span of 22.8ft and an area of 65 sq ft (the smallest jet-aircraft wing area in the world). Its length is 20.9ft. It is fully aerobatic and oil and fuel systems are designed to permit inverted flight. With a maximum speed of 332 m.p.h. it has a cruising speed of 300 m.p.h. and, pending the full investigation of the slow-speed handling characteristics, the approach is made at about 115 m.p.h. Touchdown is at about 90 m.p.h. without the use of full flap. The Somers Kendall Company hopes to be able to sell these aircraft at about £10,000 each, and some foreign governments are already reported to be showing an interest in them as trainers.



***IN FOR A MAJOR:** The first of fifteen Sunderland 5s of the French Naval Air Service arriving at Short Bros. and Harlands' Queen's Island Works for major servicing and overhaul. It was originally delivered to the French early in 1952.*

***PROMISING MIDGET:** The Somers-Kendall SK-1, seen landing at right, made its public début at Woodley last Friday in the hands of Mr. Hugh Kendall. The view of the rear cockpit (left) reveals, in the absence of the seat, the intakes and boundary-layer bleed layout with oil tanks and contents-gauge window between. Below are the fuel collector tank, refuelling pipe, and mainwheel leg attachment to the main spar.*



A new photograph of the Tyne in prototype form. Points of note are the neat annular intake, with oil tank around the outside, and the very small diameter of the rotating portions of the engine. Special design of the compound-epicyclic reduction gear and engine mountings will result in minimum vibration.

DERBY TURBOPROP DEVELOPMENT

New Transport Engines of Outstanding Promise and Significance

FIRST turboprop to go into airline service, the Rolls-Royce Dart has now "notched up" half a million hours of operation in all parts of the world. It is largely this great background of experience which has enabled the Derby company to "stretch" the Dart into an ever-improving family.

The original Dart was described in our issue of September 8th, 1949. On January 14th of this year we published a detailed account of the improvements made in the current types of Dart, and further information was given in the first Albert Plesman Memorial Lecture, by Mr. J. D. Pearson, managing director of the Rolls-Royce Aero-Engine Division, reported on September 16th last.

It is a mixed blessing that the Dart is of such early conception. One eminent British speaker has described it as "agricultural machinery"; but the same authority uses over 100 Darts and has found them singularly reliable. Last week we published an article by an engineer of Trans-Australian Airlines, in which the record of the engine was described as "far superior to anything . . . . ever experienced with the best of piston engines." Mr. Pearson himself believes that the Dart is working almost too well, and there may still be "some troubles locked away inside it which it is being reluctant to reveal." Anyway, it has a grand record, and for many months has been overhauled on a 1,050-hr basis.

Most Darts so far delivered have been Mk 505 or 506. In the Mk 510 many improvements have led to increased efficiency, and one of the most significant is the new helical reduction gear, which has made possible a considerable increase in take-off power. The next stage is the RDa.7 rating, in which, as a result of a complete redesign of the gas path, the mass flow is increased by 10 per cent to 22 lb/sec. A third turbine stage is also fitted, in order to take full advantage of the increase in power and to improve efficiency.

As a result the take-off rating has gone up to 2,105 e.h.p. for a moderate weight increase and an addition of half-an-inch in overall length. At representative cruising conditions some 340 additional e.h.p. are available, with markedly better specific fuel consumption. As noted elsewhere in this issue, later Viscounts will be able to cruise at better than 365 m.p.h. on the RDa.7, although in these aircraft the full take-off power is neither necessary nor desirable (owing to fin size limitation, which militates against the engine-cut case). Derated to 1,700 s.h.p. the RDa.7 will suit the Viscount well and can then use the same airscrew and reduction gear as that of the Dart 510.

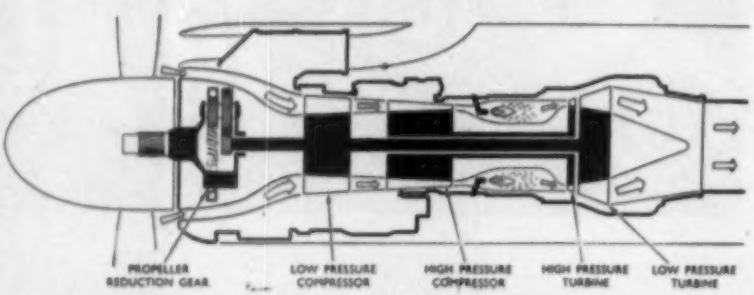
Rolls-Royce are not saying anything about Darts later than the RDa.7, but it is clear that there is plenty of further stretch in the engine. Mr. Peter Masefield has, in fact, shown a curve (2,750 h.p. by 1960) for an RDa.8.

Several years ago Rolls-Royce put the limit of Dart stretch at around 2,000 h.p., and they accordingly set about planning a new turboprop starting life at about 2,500 h.p. This engine is the RB.109 (now named the Tyne), and it is a reflection of the rapidity of modern development that it has already grown into an engine in the over-4,000 h.p. class. Such an increase in power is phenomenal, even for Derby, and it has been made possible only by the most advanced design and by the employment of new techniques. Without doubt one of the most potent of these techniques is air-cooled turbine blading; but more of this anon.

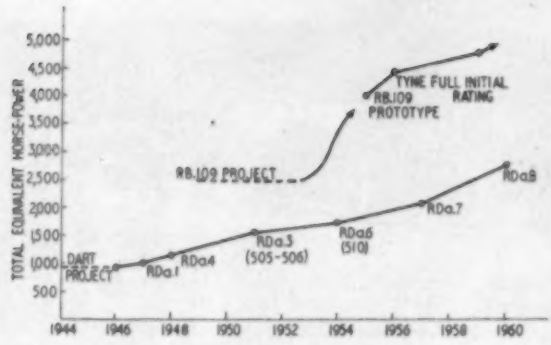
Naturally enough, the Derby engineers made the Tyne an axial engine. High pressure ratio is an obvious path to improved efficiency in any gas turbine, and Rolls-Royce have selected an exceptionally high value—12:1—for their new turboprop. On a single-shaft engine this would be rather too much for easy handling, but the Tyne is a split-compressor (two-spool) engine, and the high pressure ratio is no embarrassment. No details of the design of the compressor may yet be published, but it is based on the latest principles and has a very high work-per-stage.

In turboprops, there is every advantage in increasing both pressure ratio and maximum combustion temperature. Conversely, a turbojet is not greatly improved by increase in this latter parameter; in fact, at long ranges, it can even be adversely affected. Mr. George Edwards has said that efficiencies added up with the turboprop but did not when the 'prop' was taken off. As a result, the Tyne is one of the hottest engines—in both senses—ever to be offered for the civil market.

The combustion system is clearly of the annular type, and its extremely small diameter bespeaks outstandingly good design. Curiously enough, the spacing of the burners appears to be irregular, but this may be misleading. The actual combustion temperature has not been released, but at full power is likely to exceed 1,150 or 1,200 deg K. To accept such a temperature without sacrificing life, air-cooled blades are fitted to at least the first turbine stage (rotor, as well as nozzle guide vanes), and possibly to the second. The blades are manufactured with integral cooling passages through which compressor bleed air can be forced to maintain the maximum metal temperature at an acceptable value. Naturally such an arrangement increases the stress in the blade (as a result of reduced cross-section), and also expends air which would otherwise help to drive the turbine, but the increase in operating temperature which it allows results in a very great increase in power. No details of the mechanical design of the air-cooling may yet be revealed, but it can be stated that Rolls-Royce have already gained extensive experience with it on



Longitudinal section of the Tyne, showing airflow through the engine itself (at about 41 lb/sec) and through the twin oil cooler above. The two-spool layout is clearly shown.



An approximate outline of the manner in which the two great Rolls-Royce turboprops have developed and will progress in the future.

ROLLS-ROYCE TURBOPROPS

	Dart 510	RDa. 7	Tyne
Take-off: shaft horse-power	1,600	1,910	4,020
thrust (lb)	370	505	1,175
total equivalent h.p.	1,742	2,105	4,470
Cruising (see footnote):			
S.h.p.	945	1,227	2,270
Thrust (lb)	37	92	150
Total e.h.p.	985	1,325	2,470
S.f.c. (lb/hr/e.h.p.)	0.63	0.57	0.414
Length to cone fitting line (in)	90.3	90.8	97.15
Height overall (in)	Dia. 38.0	Dia. 37.9	40.5
Width (in)			37.4
Net dry weight (lb)	1,110	1,201	1,880
Specific weigh: (lb/e.h.p.)	0.636	0.57	0.42
Reduction gear ratio	0.093:1	0.093:1	0.062:1

Note.—The cruising performance for the Darts is based on an altitude of 20,000ft; that for the Tyne assumes 425 m.p.h. at 25,000ft.

advanced Avons, and they know how it can best be employed.

A very considerable amount of rig testing has already been completed upon the Tyne control system. A single-lever control is to be used, interconnected with the airscrew controller and also with an unspecified form of automatic temperature control. Thus the single pilot's lever selects the correct power, and the relationship between the engine output, airscrew speed and other factors is automatically maintained at the optimum for all values of altitude, forward speed and air temperature.

Airscrews for the Tyne have been developed by both de Havilland Propellers and Rotol. Both companies have gone for units with four solid light-alloy blades, the D.H. product having a diameter of 14ft (later to be 14ft 6in) and the Rotol two feet greater. Both are, of course, feathering and reversing, and are fitted with electric de-icing on blades and spinner. The Tyne cowling will also have electro-thermal de-icing, and hot air is tapped off the compressor for heating the intake guide vanes and upstream end of the compressor.

Detail design of the Tyne began in 1953. Very exhaustive rig and bench testing has proceeded ever since and the first prototype engine ran as a unit in April of this year. It has since been joined by two other prototypes, and further engines are under construction for development purposes. The first flight will take place early next year, when a Lincoln will fly with a Tyne in its nose. This aircraft will undertake all the difficult early handling trials, icing tests and similar programmes. Later, two Tynes will be fitted in G-AKRD, the Ministry of Supply Ambassador at present used for Proteus development. It is the intention that this aircraft will be put into scheduled service, possibly as a freighter.

R.A.F. STRENGTH

—in Men and Transport Aircraft: a Plea by Lord Templewood

RECRUITING for the Royal Air Force, and the necessity of efficient equipment for air trooping, were two of the principal topics in an admirably analytical speech by Lord Templewood (who, as Sir Samuel Hoare, was Air Minister in 1922-24, 1924-29 and 1940). He was addressing guests at a luncheon given by the Air League of the British Empire at the Mansion House, London, on October 12th.

Lord Templewood began his speech by welcoming among the guests Lord Trenchard—"the father of all air forces, the prophet." He (Lord Templewood) had learned about aviation in a good school—the Trenchard school, in which the truth of the teaching remained unaffected by material changes.

Going on to speak of the continuing necessity for a strong Air Force, Lord Templewood examined the reasons for the shortage of technicians in the ranks of the R.A.F. The present system of short-term National Service, he thought, was not suited to a technical service like the R.A.F. Recruits were trained at great expense and at the end of their two years' service were still largely inexperienced. Each man had probably cost the country £5,000. Could there be a more wasteful and extravagant way of providing technicians? If the period of National Service had been reduced, the position would have been even worse. Postponing the age of calling up was perhaps the best temporary alternative, but it had its own serious defects.

Men were not driven into the ranks by unemployment nowadays and new problems had to be faced in attracting entrants for long-term commissions. There was a need for better standards of living, as business firms now provided considerable facilities for the families of employees, and some even helped with grants for the education of children. Many Government departments also gave up to £150 a year, tax free, for each child to enable overseas officials to send their children to schools at home. R.A.F. personnel were constantly on the move, yet no grant had been made for education. The Air League had been demanding such facilities for two years, and the speaker had raised the question in Parliament on a number of occasions. He was glad to hear that the Government intended to increase R.A.F. pay and pensions.

Lord Templewood then turned to the subject of air transport, saying: "I come now to the last of my comments. It concerns civil aviation as well as military aviation. It concerns also the future of the aircraft industry. Why, I ask, are we not making greater use of the unique opportunities that transport aircraft offer to a far-flung Commonwealth with many overseas responsibilities? What is the use of talking of a mobile strategic reserve if we do not take full advantage of the most mobile method of transport? Air transport is a vital element of air power."

Our American allies had grasped the fact that air transport was essential to mobile defence both in peace and war. They had created a military air transport service on a huge scale, and it lifted over 230,000 men and 60,000 tons of high-priority equipment across the Pacific during the Korean campaign, quite apart from the heavy bomber squadrons which the Air Force flew across with their equipment. During last year M.A.T.S. had averaged a flight across the Atlantic and Pacific Oceans every 54 minutes. "Suppose," said the speaker, "that we adopted air transport on these lines for all our trooping and priority equipment, what a saving there would be in time in men, in stores, in bases! What an advantage we should gain by this increased mobility! We have shown by the great achievement of the Berlin airlift that we are capable of making the change. Our Comets and Britannias prove the capacity of our aircraft industry."

Lord Templewood went on to say that a far-seeing and long-term programme of air transport would be of inestimable value to the aircraft industry at a time when disarmament might lead to a reduction in the demand for bombers and fighters. The aircraft industry was now one of our greatest. Last year it exported £56m worth of aircraft, £6m more than the total export of ships; in August of this year, when it was becoming more difficult for most British exports to hold their own, aircraft exports amounted to £5,436,000, an increase of £1,362,000 over August 1954. It would be a shattering blow to British prestige, British credit and British defence if the industry were allowed to drift into the miserable state in which it was left in the years after the First World War.

A sound home market was an essential basis. A single instance of the magnitude of America's home market, in particular for transport aircraft for the Services, was afforded by the orders received by one company, Lockheed, during the first week of this month. The U.S.A.F. placed a third order for the Hercules C-130 valued at some £40m sterling—equal to a full year's production. This firm also had received orders amounting to nearly £50m from three American air operators; thus in one week one company's home market had produced orders for nearly £100m.

Within the next few years there would be a demand in the world export market for between 400 and 500 large transport aircraft, costing something like a million pounds each. The American industry would be in that battle, and with the great advantage of an assured home market, with all that went with it in the way of research and development and cheapening of costs through large-scale production.

Not least of the advantages of a great development of air transport, added Lord Templewood, would be the facilities provided for keeping Service families united and for improving the social conditions of Service life.

Other speakers at the luncheon were Air Chief Marshal Sir George Pirie (chairman of the Air League), who proposed the toast of the Lord Mayor and Corporation; Sir Seymour Howard, who replied; and Lord Sempill.

HERE AND THERE

FOR THE AIR/GROUND TEAM: Newly accepted by the U.S. Marine Corps is this improved version of the Cessna Bird Dog liaison aircraft. Designated OE-2, it has a redesigned tail, flak curtains, seat armour and self-sealing tanks, improved radio and rocket target-marking equipment. A 250 lb load can be carried under each wing.

A Record Claimed—

THE U.S. Navy announced last Monday that a Douglas A4D Skyhawk carrier-borne attack aircraft had established a new world speed record over 500 km at Muroc, California. The Skyhawk's speed was 695.163 m.p.h., a notable improvement over the former record of 649.46 m.p.h., held by an F-86H.

—and Five Confirmed

RECORDS lately confirmed by the F.A.I. include those by the London-Baghdad (525.482 m.p.h.) and Singapore-Darwin (518.36 m.p.h.) Valiant; and by the "two-way" transatlantic Canberra—London to New York, 461.12 m.p.h.; return, 550.35 m.p.h.; out and return, 481.935 m.p.h.

Chipmunks for Australia?

FROM Australia it is reported that the Aero-Prop Federation is negotiating to buy 20 Chipmunks from the R.A.F. They are needed "to meet the growing interest in flying among young Australians." The Aero-Prop Federation comprises 17 major Government-subsidized clubs in all Australian States.

Helicopters and Atoms

A COMPANY which is using helicopters to ferry overseas visitors from London Airport to its factory in Crawley New Town, thirty miles away, is Edwards High Vacuum, Ltd., specialists in equipment for the application of the very low pressures required in atomic energy plants. The effectiveness of their plans was being demonstrated last Tuesday, October 18th, when a party from the Commissariat a l'Energie Atomique of France, including Professor Debeisse, the Director of the Centre d'Etudes Nucleaires de Saclay, were due to have technical discussions with the firm. Helicopter Services, Ltd., who had contracted for the flights, had previously examined the factory grounds and selected a suitable landing place close to the offices.

Sir Frank Whittle for U.S.A.

BEFORE flying to New York last week, Sir Frank Whittle said that he was, "to all intents and purposes," giving up residence in England. He would live in the United States, where he would work on a project for a subsidiary of the Shell Oil Company, to whom he is attached as a mechanical engineering specialist. From time to time he would visit both England and Holland.

About the Car Show

LAST Wednesday the Motor Show opened at Earls Court, London; and today, October 21st, a stand-to-stand report appears in *The Autocar*. Next week the Show Review number will be on sale.

Napier Spraymat in Canada

AN agreement has been signed by which the Canadian Marconi Company is given the rights to manufacture and market throughout Canada the Napier Spraymat electrical de-icing system for aircraft, developed by D. Napier and Son, Ltd. The Spraymat (described in *Flight* of March 12th, 1954) consists of three layers sprayed on to the parent material, forming a metal element sandwiched between two insulation layers. The base layer of thermosetting resin, applied by a flame spray gun, provides electrical and thermal insulation from the component; the metal, also applied by spray, is the heating element. The outer layer, of similar material to the base, is sprayed on as a final protective finish.

Free Sample

AN Aero 45 twin-engined liaison-type aircraft, a gift from Czechoslovakia, was formally handed over to India's Prime Minister at Palam airfield a few days ago.

U.S.A.F. in Australia

IN connection with the projected U.S. Antarctic expedition during the International Geophysical Year, 1957-58, a C-124 Globemaster landed at East Sale, Victoria, Australia, recently to investigate the suitability of the airfield as a base for American long-range aircraft. From East Sale, reconnaissance flights would be made over the Antarctic in support of the American expedition.

Air Kruise (Kent)

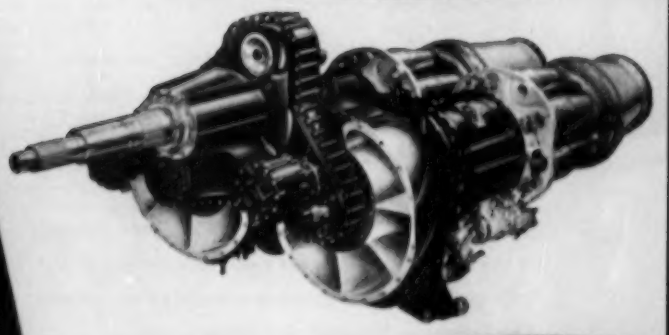
AS made clear in the text of last week's article on Air Kruise (Kent), Ltd., the company has been operating from Ferryfield since the beginning of the 1955 summer season, and was previously based at Lympne. It has no connection with Bristol: this word, in the subtitle of the article, was a misprint for "British."

GREAT-GREAT-GRANDAD of the forthcoming Vickers Vanguard turboprop transport, described on pages 650-651, this machine, of the same make and name, was flown experimentally by Imperial Airways in the 1920s. Originally fitted with Napier Lions, it later had (as shown) Rolls-Royce Condors.

SOUVENIRS: At a recent meeting of Brough R.Ae.S. branch, Mr. N. E. Rowe (left) presented tankards to Mr. G. E. Petty and (right) Mr. F. A. Wilkinson, who are retiring from the respective offices of branch chairman and secretary after ten years' service. Branch membership has topped 300.

The POWER of Armstrong Siddeley

The Fairey Gannet carrier-operated torpedo bomber of the Royal Navy owes its long range and economical cruising to the Armstrong Siddeley Double Mamba turboprop. This unique design provides twin engined performance and safety factor with the fuel economy and stowing facilities of a single engined installation.

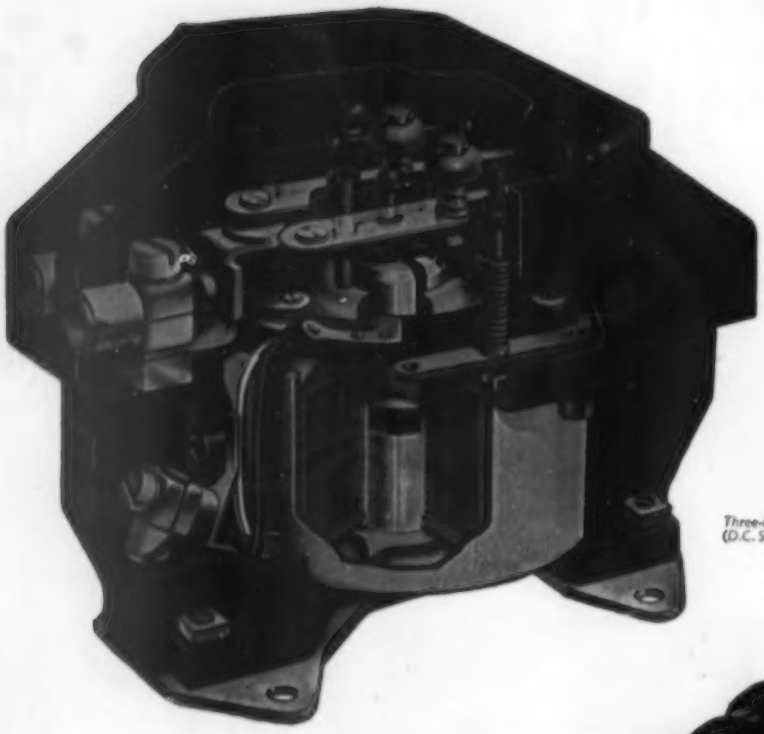


ARMSTRONG SIDDELEY

ARMSTRONG SIDDELEY MOTORS LIMITED • PARKSIDE • COVENTRY

Members of the Hawker Siddeley Group

The Electrical Aspect

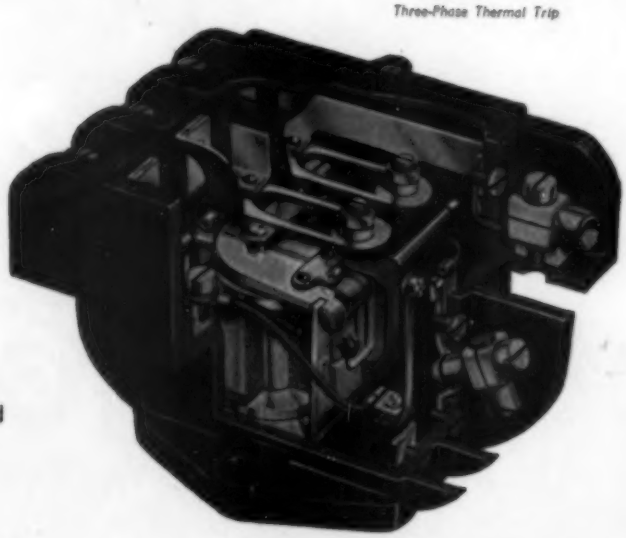


Three-Phase Contactor
(D.C. Solenoid operated)

Switchgear . . .

In relation to its application must be light, compact and easily maintained.

Three-Phase Thermal Trip



Extensive developments in the electrical power requirements of aircraft emphasized the need for a three-phase, 208-volt supply. Rotax accordingly designed and manufactured switchgear to keep pace with this new generating system.
Rotax has more experience than any other company in the design, development and manufacture of A.C. and D.C. generating systems and associated switchgear.
The Britannia, Viscount and Ambassador all carry Rotax equipment.

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LAND, SEA AND AIR

British Transport in the National Economy: an Appreciation by Mr. Peter Masefield

THE 1955 presidential address to the Institute of Transport was delivered in London on October 10th by Mr. Peter G. Masefield, M.A., M.Inst.T., F.R.Ae.S., F.Inst.Ae.S., chief executive of British European Airways. Entitled *British Transport in the National Economy and an Appreciation of its Major Components*, the paper matches, in quality, scope and statistical detail, the previous major lectures delivered by Mr. Masefield. It is, perhaps, the most ambitious attempt yet made to review the entire field of British transport. The extracts which we quote below are those most likely to be of particular interest in aviation circles.

Introducing his paper, Mr. Masefield suggested a definition of the purpose of transport: "First of all, to serve the public and—in doing so—to sell public service at a profit; except where, for special and exceptional reasons in the public interest, uneconomic services are essential." In such instances a subsidy was justified where it could be applied, and was shown to be applied, directly to the task in hand. Transport itself he defined as "the act of conveying passengers, goods and mail from the place where they happen to be to the place to which they require, are required—or can even be persuaded—to go."

The full objectives of transport [Mr. Masefield continued] can be achieved only by offering convenient, sufficient, and punctual services, at appropriate speeds and standards of comfort—not forgetting cleanliness. They must be operated with safety, economy, reliability, regularity and frequency, in adequate vehicles, with well-maintained amenities, at economic fares attractive to the public. These services must be presented with courtesy and can only be achieved with efficiency. A slovenly, unenthusiastic, or permanently unprofitable business will never achieve the objectives we seek. In fact, I suggest that the motto we should employ is that "Our customers are the purpose of our business, not an interruption of our work."

Incidentally, may I make a plea here for the proper use of the old English word "transport" in our affairs—and the eschewing of that unwieldy Americanism, "transportation"—along with those etymological horrors, "winterization," "hospitalization," "dieselization" and "anti-insecticization"? "Transportation" was certainly an old English word also. But it signified what our stern forebears did to convicts, in transporting them to the colonies "for life."

Opening his discussion on the status of the British transport industry today, Mr. Masefield noted that it directly employs, in all, some 1,345,000 persons. This made it just about the largest employing industry of the nation, with an employment total which amounted to some six per cent of the working population.

The railways [he continued] are the largest employers in British transport with 38 per cent of the total (505,000 employees). They are closely followed by road transport with 36 per cent (484,000 employees), after which comes shipping—the largest transport carriers—with 23 per cent out of the total employment (317,000 employees). Finally we have air transport with two per cent (30,000 employees) and inland waterways with 9,000 employees (one per cent).

When we add to the public transport worker those employed in the transport sections of the distributive trades, we find that, out of the British working population in civil employment of nearly 23 millions, some 1,850,000 people—or eight per cent of the total—are employed in one form of transport or another. If we then add to these all those who are employed in providing the transport industry with vehicles and equipment—shipbuilding, aircraft manufacture, vehicle building and so forth—we reach a total of 3,340,000 persons who are employed directly by, or for, transport operations.

This means, in fact, that out of a national population of 51 millions in the British Isles, some 7,200,000 men, women and children—or one in seven of the population—depend on British transport, in all its ramifications, for their livelihood and well-being.

Out of a total national income of some £19,000 million in 1954, the gross revenue earnings of British public passenger and goods transport amounted to just on £1,800 million—that is nine per cent of the total. A substantial portion of these earnings, in both shipping and air transport, were in foreign currencies—an important invisible export. The shipping contribution was some £200 million and that of air—growing every year—around £15 million.

British transport has five major components. They are—in order of traffic carryings—shipping, railways, roads, air and inland waterways. When we try to determine the relative contribution of each component to the total transport picture, the lack of detailed published financial and traffic information about all except air transport is a serious impediment. Here may I re-echo a plea—made many times before—for the official publication, nationally, of more precise and comprehensive statistics, especially on the part of shipping and road haulage. In air transport—one of the most intensely competitive of businesses—we have found much more to be gained than lost by the publication of "full information."

The lecturer next discussed each of the five major components in turn.

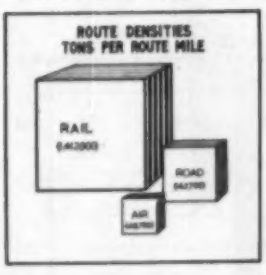
Shipping.—Traditionally and economically, in our great seafaring nation, by far the largest single component in British transport is shipping. The British Mercantile Marine is still, in fact, the largest on the world's seas by a substantial margin. British shipping, indeed, earns some 44 per cent of the total revenue of British transport as a whole, while it carries some 94 per cent of the traffic—amounting to some 716,000 million load ton miles—the transport unit of earning power. These loads were carried in about 3,200 vessels which, during 1954, steamed 102 million ship miles at an average speed of some 13 knots (15 m.p.h.).

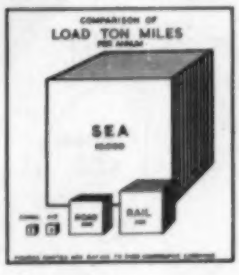
One of the economic advantages to be gained from use of large vehicles is brought out in the shipping figures. While carrying 94 per cent of the traffic, shipping employs only 23 per cent of the total manpower in British transport. The mean operating cost for the shipping industry as a whole works out at only one-seventh of a penny for each capacity-ton-mile worked, and is substantially the lowest of any means of transport. It is, in fact, half the mean rate for all forms of transport. In other words, bulk transport by sea in large vessels is the cheapest way of carrying goods over longer distances at relatively slow speeds. The cost of conveying passengers by sea is, however, a great deal higher—passenger fares ranging in fact between about fourpence and ninepence a passenger mile, figures which are at the same level as those of air transport.

British shipping appears to achieve a fair surplus of revenue over operating costs—a margin of at least 11 per cent, which amounts to about £80 million per annum. This is achieved at the low average revenue rate of only one farthing for each load ton-mile sold. The break-even load factor for British shipping as a whole appears to work out at around 52 per cent, compared with the 58 per cent load factor achieved. Revenue from passengers accounted for 9.5 per cent of British shipping earnings—about £75 million out of £790 million. Thus shipping is primarily a carrier of bulk goods, cheaply.

Taken all round, shipping dominates British transport as a result of its enormous freight figures, and appears to be in a thoroughly healthy condition in 1955.

British transport: two of Mr. Masefield's simple but vivid diagrams.





Railways.—Next in order of traffic comes British railways, including the railway—and Underground—element of London Transport. In 1954/55 the railways carried 3.6 per cent of the total traffic of British transport (63 per cent, excluding shipping) while they earned 25.4 per cent of the total revenue.

The specific operating cost of railway transport worked out at 1.5 pence per capacity ton mile against earnings at a mean rate of fourpence a load ton mile. Unfortunately the achieved load factor was low at only some 38 per cent—although the break-even load factor on operating costs was lower still at only 36 per cent. This is the lowest break-even load factor of any form of transport.

The railway surplus of £20 million of revenue over operating expenditure (4.5 per cent) in 1954 has been bedevilled by very high interest charges—about £42 million—on a backbreaking capital of £1,500 million, a large part of which represents now

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obsolete assets yet is still a heavy financial burden. Railway specific operating costs—although ten times those of shipping—average less than half those of road transport. The staff numbers—505,000—are, however, the largest of any of the components of transport. Passenger traffic accounted for only nine per cent of the load ton miles performed by the railways, while passenger revenue represented 30 per cent of railway earnings. The bulk of railway business is thus in goods traffic. Taken all round, the railways are operating under severe difficulties, carrying substantial traffic at low load factors in obsolescent equipment, while weighed down by heavy charges on a capital which is five times the annual operating revenue. We may hope that new capital investments will offer much better returns.

Roads.—British road transport—buses, coaches, and all types of trucks—far outweighs all other means of transport in one particular—the number of passengers carried. No less than 16,700 million passengers were carried by British road transport in 1954/55, although the average distance travelled was only three miles. The passenger miles performed by road transport represented 63 per cent of the total of British transport—more than twice the figure for railways.

All this adds up to the fact that the public road services are hauling rather more than half the traffic of the railways—including many more passengers at nearly twice the revenue rate from each load ton mile sold. Road transport as a whole appears to be making a surplus of about £32 million (or 6.9 per cent) on its operating costs in 1954/55. Unlike shipping or railways, passenger transport is the most important element of road services on the revenue account. All the figures for road transport exclude "C Licence" traffic which adds a further 60 per cent to the load ton miles. The total load ton miles carried by road then add up to almost the same as those carried by rail.

Air.—Newest of all forms of transport, British air services are now firmly on their feet. As yet their ratios of traffic and earnings are small compared with ships, rail and roads. But they are expanding fast, at the rate of about 20 per cent per annum—and they cater primarily for passengers. In 1954/55, British air transport—B.E.A., B.O.A.C. and the independent operators—earned some £65 million of revenue and operated 402 million capacity ton miles while carrying some three million passengers for an average journey distance of 700 miles each. The passenger miles performed were 2.4 per cent of the grand total, but passenger traffic by air accounts for 76 per cent of all air load ton miles and 66 per cent of air transport's revenue.

The revenue from air transport amounted to 3.5 per cent of the total for British transport although, compared with other forms of transport, the load ton miles—0.04 per cent—appear small. The 263,000,000 load ton miles were operated in 360 aircraft which flew 76 million miles at an average of 180 m.p.h.—about ten times faster than the average of surface transport. Air transport is, of course, selling speed and—in the year reviewed—this cost 37.0 pence per capacity ton mile, which is more than 260 times the specific cost of sea transport. The capacity available was, however, sold at the highest load factor of any of the transport components—65 per cent—indicating that the fares structure is not set too high for the type of traffic carried and the service provided—while the break-even load factor was 62 per cent. As a result there was a £3m—or 5 per cent—surplus of revenue over operating cost; and more than £1 million profit after all finance charges had been paid. The £4 million surplus represents a return of 3.3 per cent on the total investment of some £120 million.

Air transport differs fundamentally from sea transport in that its revenue comes predominantly—66 per cent—from passengers. Thus its cost structure is related primarily to passenger carriage whereas that of shipping is primarily to bulk goods.

British air transport as a whole has at last climbed out of the "red" for the first time in its history and, although it still remains a high-cost means of transport, the speed and convenience which it offers are fully marketable at the fares charged—witness the relatively high load factors. As a means of passenger and mail transport, especially over longer distances, aviation is now an essential feature of the national economy.

Inland Waterways.—Finally come the canals and other navigable waterways inland. Compared with their hey-day in the 18th century, when immense profits were made on the sale of canal shares, the inland waterways today present a sad picture.

During 1954/55, 225m load ton miles of traffic were performed on inland waterways in Great Britain. Of this amount some 49,000,000 L.T.M. were recorded on the British Transport Commission vessels which earned a revenue of about £1,000,000. In all 4,050 barges plodded some 8 million miles, achieving a load factor of 54 per cent at an average speed of 5.5 miles an hour. Costs were, on average, 2.7 pence per capacity ton mile. The revenue rate was, however, comparable with that of rail transport at 4.9 pence per load ton mile—just enough to break-even on operating costs. Employment of 9,000 persons makes canals substantially the smallest component in British transport. The high cost and low speed of the inland waterways is a disappointing feature of what—had they been planned for development—ought to be a cheap form of transport. Narrow canals with many locks form the fundamental impediment.

Need for Capital Expansion

The total capital invested in British transport [Mr. Masefield continued] is difficult to determine with accuracy. It appears to be in the neighbourhood of £4,000 million. Thus the revenue of £1,814 million represents a turnover of 44 per cent on the investment and the surplus of revenue over operating expenditure gains, in all, a return of some 5½ per cent on the investment. Taken as a whole, therefore, British transport is a profitable business.

Surveying the operating surplus of £135 million over the £1,679 million operating cost, however, naturally raises the general question of whether the industry, as a whole, is working at a sufficient margin for financial stability.

An operating surplus of 15 per cent or so, which I suggest is desirable, would mean a rather higher rate than at present were it applied to the industry as a whole—and surplus of around £205 million a year. It would nevertheless represent a return of less than seven per cent on the total capital investment. Such a figure could, in fact, have most beneficial results, if the profits were devoted to capital expansion. The fact is that there can be no doubt at all that not enough is being ploughed back into the development, maintenance and replacement of fixed assets—such as roads, rails, vehicles and so forth.

We live in days of restricted public capital investment. Indeed, transport has been starved of capital expenditure since the war. That is a factor which is causing operating costs—and, hence, fares—to be higher than they should be if full advantage could be taken of technical developments now possible. In the national interest, capital expenditure on the part of the Government, particularly on railway modernization and new roads, is vital.

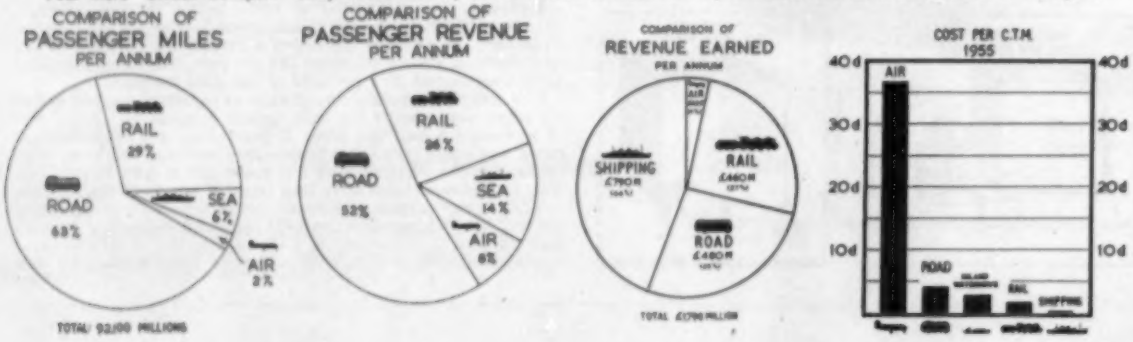
[Mr. Masefield then analyzed at some length the major factors which influence the cost structure of the various forms of transport. After discussing the development of a typical British route, that between London and Edinburgh, Mr. Masefield turned to a consideration of policies, prospects and future possibilities.]

In my view [he continued] there are three requisites if British transport is to go forward to exploit fully all the potentialities of which it is capable:—

(1) Amenities: adequate capital expenditure on terminal provisions, tracks and vehicles to improve service and to reduce operating costs. (2) Administration: operation in units of adequate but not unwieldy size. (3) Control: no competing form of transport to possess control of any other.

In all this complex, the much-debated issue of State and private ownership is, in fact, in my view quite immaterial so long as:—The individual operating companies are of the right size for efficiency—neither too big nor too small; adequate capital is available at reasonable rates of interest; there is freedom for enlightened management, practised with skill; the objective of offering the best possible product, at the cheapest economic price,

Four more "British transport" comparisons used by Mr. Masefield to illustrate his presidential address to the Institute of Transport.



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BRITISH EUROPEAN AIRWAYS

LAND, SEA AND AIR . . .

is maintained; each operating unit is conducted with enthusiasm; and happy relations are achieved.

In the particular field of air transport, I believe that, as things have turned out, we have a more advanced component of the industry today, as a result of the policy which has produced B.E.A. and B.O.A.C., than would have resulted under other arrangements.

Operating organizations should be neither too large nor too small. And, although no dogmatic rule can be laid down for the size of transport units as a whole, in general, railways appear to have a larger efficient size than airlines. Airlines can probably be, efficiently, bigger than motor-coach companies. My own belief is that, in airline operations, staff numbers of between 12,000 and 16,000—efficiently used at a high productivity—are likely to be about right for the most efficient results. Less than this means that essential overheads tend to be too large a proportion of the total. More than this tends to get cumbersome, impersonal and unwieldy or too widely decentralized for efficiency.

Allied to this—and subject to the size of the particular business justifying them—is the importance of having more than one operating unit in any industry which is expanding and developing fast. Not only do a number of separate entities make possible a comparison of efficiency and a spur to higher endeavours, but also they give outlets for imaginative, and differing, managerial approaches, a wider market for employment and recruitment and better opportunities for building up "esprit de corps." Let us never sink back to the bad old doctrine of a "single chosen instrument" in any major form of national transport.

On the subject of co-ordination, there are many opportunities for interline developments by differing means of transport. There are many communities of interest—but, in my view, little valid reason for control of one form by the other. In the United States, where Congress has for long insisted that the various forms of transport shall be independent of each other, the Civil Aeronautics Board has interpreted the Civil Aeronautics Act (Section 408b) in such a way that shipping companies have been barred from engaging directly (or indirectly through the control of subsidiary companies) in air transport.

The attitude of British shipping people in this matter is different. There is a tendency for British shipping to move into air transport by buying control of independent companies. Although there is no doubt a feeling that the older component of the transport industry should be closely in touch with potentialities in the new, the chief motive seems to be a concern about the effect of reducing air fares on shipping passenger traffic. The fact is that, whereas shipping fares may possibly have to rise as labour and other costs increase, unsubsidized air fares are likely to fall because far-reaching, cost-reducing, technological development, and increased revenue carrying capacity, will outweigh the other, cost-increasing factors. But, although the shipping business may be concerned by these trends, the public at large will rejoice at the prospect of lower air fares.

All this is not academic because already—for better or for worse—most of the major British privately-owned airline companies are now controlled by shipping interests . . . The one saving grace is that the two national British Airways Corporations are now strong enough, and on a profitable enough basis, to ensure the continued development of British air transport in the best interests of the travelling public.

[The lecturer then criticized the manner in which, under present policy, licences for air routes are awarded in the U.K.] I commend [he continued] an Anglicized version of the C.A.B. approach as a worthy development of the present U.K. method, which might be described as "catch-as-catch-can in the nicest possible way."

[Looking ahead, Mr. Masefield made a plea for the monorail, which, he said, appeared to have serious possibilities—combining high speeds with reasonable costs for certain limited purposes over high-density short routes. Its novelty was an impediment to its exploitation, but if preliminary analyses were confirmed, there seemed to be an excellent case for its further development: "Indeed, in the future, the aeroplane and the monorail in conjunction could provide a most worthwhile advance in journey speeds over anything we have today. The helicopter promises to provide the fastest means of transport over distances of up to about 140 miles but, beyond that, a combined aeroplane/monorail service would offer a great advance over any foreseeable alternative." Finally, Mr. Masefield considered future developments in air transport.]

The helicopter [he continued] is considered the fashionable possibility for future inter-city transport. And it may well become so if certain inherent drawbacks can be overcome. At present the appearances are that, until a satisfactory multi-engined helicopter, capable of carrying not less than 50 passengers at not less than 150 m.p.h., can be produced, the helicopter will remain an expensive adjunct to normal fixed-wing services.

In the further distant future, however, the vertical-rising jet aircraft, capable of supersonic speeds of the order of 1,800 m.p.h. may well come into the picture. When vertical take-off and landing is possible, we may at last be able to discard the acres of concrete which now constitute modern airports. One major issue will—however—still remain: noise. If these new era vertical-rising aircraft are to operate, tolerably, from city centres they may have to fly from underground air terminals from which they would take-off vertically "up-the-spout." The noise problem will remain formidable unless and until we can evolve some form of electro-gravitic power unit—of which possibilities exist.

ANOTHER SIDE TO SHORTS

Work of the Company's Flying Services Division

ROCHESTER, Kent, where the first Short "225" was coaxed on to the River Medway in 1915, is today the home of the Flying Services Division of Short Brothers and Harland, Ltd. This little-publicized aspect of Short's responsibility, the major part of which is of course the design and production organization at Belfast, has its origins in the flying training school opened at Rochester in 1938; nowadays the emphasis has shifted to wider spheres of activity, including aircraft modification, repair, maintenance, flight testing and ferrying at six separate bases in England, Wales and Northern Ireland.

Short's Ferry Flight, responsible for the ferrying of all aircraft of the Royal Navy, has delivered 7,300 aircraft of 26 different types.

We recently had an opportunity to inspect the central administration of the Division at Rochester. One catches a momentary breath of the by-gone on the approach to the pleasant grass airfield on the green plateau overlooking the River Medway—a feeling accentuated by the presence of Beaufighters, Dragon Rapides, Sturgeons, Oxfords and Tiger Moths, each representing some particular activity of the Division.

The prime responsibility at Rochester is the operation of a Naval Ferry Flight. This unit has the task of air-ferrying all aircraft of the Royal Navy, and up to the beginning of October it had delivered 7,300 aircraft of 26 types to Fleet Air Arm bases in the United Kingdom and the Mediterranean theatre. There are 17 pilots in the Ferry Flight, commanded by Lt. Cdr. A. E. R. Forwood, R.N. (Retd.).

Our pleasure at seeing a beautifully finished Beaufighter T.T. Mk 10, bedecked in startling black and yellow, increased when we learnt that squadrons of these veterans are due to be at work with the R.A.F. in the Middle and Far East as drogue-towers, exercising ground and air defences in those theatres. Work on the refurbishing of Beaufighters, under contract to Bristols, was begun by Shorts in January, and the first completed aircraft emerged from the factory last week. There are half-a-dozen at

The first Beaufighter T.T.Mk 10 as rejuvenated by Shorts for a further long spell of target-towing in the Far East. These fine aircraft have many years of such work ahead of them.

ANOTHER SIDE TO SHORTS . . .

present in the factory in various stages of completion after initial strip-down to first principles.

Partners of the Beaufighter in the target-towing business, Short Sturgeon T.T.Mk. 2s are being processed in a nearby hangar from complete strip to as-new finish; an interesting modification is the re-fashioning of the rather unbecoming long nose to improve visibility. There is, of course, no longer a requirement for a wide-sweeping camera, and about 8ft of nose is removed, with no apparent effect on trim. There are, incidentally, eighteen Sturgeons based at the Royal Navy's air station at Halfar, Malta, where they are used to tug heavy 23ft drogues to test the proficiency of fleet anti-aircraft batteries.

The Short Sturgeon, despite its formidable appearance, has always been regarded as a most gentlemanly aeroplane to fly, and its mighty reserve of power and long endurance make it ideal for the job of lifting heavy drogues for long periods. These qualities, plus the aircraft's internal roominess, were no doubt a factor in the choice of a Sturgeon (actually the second prototype) for the first air-test of a very advanced type of auto-pilot designed by Elliott Bros., Ltd., of Rochester. Work on the adaptation of the aircraft by Shorts in their general overhaul shop is progressing steadily. In the same department we saw also a variety of interesting aircraft in the process of reconditioning, including one of Shell's two Sealands, flown from New Guinea for overhaul by its makers. Shorts, who as marine aircraft builders by tradition have as much experience as anyone of corrosion, have been surprised at the corroding effect of water operation in the tropics.

A rather special flying activity at Rochester is the operation of a fleet of Airspeed Oxford Mk 1s to exercise the R.A.F.'s ground-based fighter-control system in the United Kingdom. It has been found that high-speed aircraft are unsuitable for providing inexperienced ground controllers with vectoring practice, and the Oxford has proved to be a very satisfactory "fighter" for trainee controllers.

There is also a small civil flying club at Rochester administered by Shorts which includes among its business the training of selected A.T.C. cadets for the Air Ministry.

Short's base at **Bovingdon Airport, Hertfordshire,** counts among its activities the maintenance of more than half a dozen types of aircraft, including those operated by the communications squadrons of Fighter and Coastal Commands, the Joint Services Staff College, and the Savoia Marchetti of Italian Embassy. Facilities here provide for the servicing of instruments, electrical equipment, radio, ground equipment, and parachutes.

At **Llanbedr, North Wales,** the division has a unit which provides air co-operation for army anti-aircraft batteries based in North Wales and in addition there is a flight of Mosquitoes used for fighter-control exercises. A fleet of mixed piston and jet types, including Firefly and Meteor, is operated for the Ministry of Supply in the development of guided weapons.

The R.A.F. aerodrome at **Woodvale, Lancashire,** is the base of Short's Meteorological Flight. A Spitfire 19 is used for the daily ascent to 30,000ft, and the nature of this work is best illustrated by the citation of the award of the L. G. Groves Memorial Prize to its pilot, F/L. J. Formby, R.A.F.R.O.:—

"Since September 1952, Flight Lieutenant Formby has been engaged in carrying out the meteorological vertical ascents which are performed daily from R.A.F. Station, Woodvale. He has made over 450 such flights and during one period he was called upon to make the ascent every day for five weeks. Throughout this period of service he has shown marked enthusiasm for this task and exceptional ability both as a pilot and as a meteorological observer."

Also at Woodvale is a second unit of Oxfords, which performs a task similar to that of the Rochester-based fleet—the exercising of ground fighter-controllers. The Chipmunks of Liverpool and Manchester University Air Squadrons are maintained by Shorts at Woodvale.

At **Newtownards, Northern Ireland,** Shorts provide airfield facilities for the Silver City car ferry service recently introduced to fly cars and passengers between Northern Ireland and England and Scotland, and for the local civil flying club.

At **Sydenham, Belfast,** the division operates another flight of Oxfords for the exercising of the Northern Irish fighter-control system, and also maintains the Chipmunks of the Queen's University Air Squadron.

Management and control of the whole of Short's Flying Services Division is administered from its Rochester headquarters by W/C. T. C. Chambers, A.F.C. (R.A.F. Retd.), who has been with the Division since its formation in 1938.

F/L. J. Formby is the pilot of the Spitfire 19 operated by Shorts on the daily met. flight from Woodvale, Lancashire. In the past three years F/L. Formby has made 500 ascents, involving 835 flying hours.

A Short Sturgeon T.T.Mk 2 of the Royal Navy, seen here after its "face-lift" and overhaul at Rochester. The original long camera-nose has been removed to improve visibility, and all Sturgeons operating on fleet target-towing duties in the Mediterranean are being so modified.

Accountant in the Making

A Preliminary Design-review

A sectioned illustration of the Aviation Traders' Accountant turboprop airliner.

1 Radio operator.
2 Emergency crew exit.
3 Crew and freight door.
4 Steerable nosewheel.
5 Detachable floor.
6 Rotol 10ft airscrew.
7 Rolls-Royce RDa.6 Mk 510 turboprop.
8 Cabin cooling air-intake.
9 Pressure-refuelling point.
10 Double-skin de-icing duct.
11 Integral-tank inspection cover.
12 Integral fuel tank (565 Imp. gal each).
13 Double-slotted flap.
14 Long-range fuel tank (75 Imp. gal each).
15 Cabin air heat-exchanger.
16 Water/methanol tank.
17 Baggage and emergency door.
18 Toilet.
19 Double-tier baggage compartment.

THE firm of Aviation Traders, Ltd., first announced plans for the Accountant airliner (two Rolls-Royce Dart RDa.6 turboprops) two years ago. The fact that in the meantime only basic performance data and a few design details have so far been made public (*Flight*, August 12th, 1955 and September 10th, 1954) is no measure of the headway made with a project that promises to be a challenging contender for the "maid-of-all-work" market. The aircraft has steadily progressed to the detail design stage, with construction of the prototype advancing well towards a first-flight date in the spring.

Now that the basic design decisions have been taken it is appropriate to describe briefly the aircraft's structure, systems and services in anticipation of the fuller account which must abide a later date.

For good measure, weights and performance data are included in their most up-to-date form, together with as yet unpublished illustrations of payload/range capabilities and operating cost. The accommodation drawing is of particular interest in that it includes what appears to be an exceptionally well-appointed executive layout.

Powerplant.—The engines are Rolls-Royce Dart RDa.6 Mk 510 turbines of 1,780 e.h.p. each, driving Rotol 10ft airscrews. The powerplant is to a large extent exactly interchangeable with that of the Vickers Viscount. The designers of the Accountant, at a very early date in its evolution, recognized the necessity of offering operators a well-tried engine in quantity production and backed by a world-wide technical service. Complete access to all services and accessories in both compressor zone and combustion zone is available, and the installation repeats the petal-type cowling of the Viscount.

Engine-driven accessories comprise alternator, cabin supercharger, hydraulic pump and tacho-generator. All engine controls are of push-pull type, and are adjustable for length with indexed settings, the system being rigid and free from lost movement.

Structure.—The fuselage is constructed by the "tensioned skin" method, as described in *Flight* of July 31st, 1953. The method ensures a light, stiff structure, simple to build and, it is claimed, requiring the minimum expenditure on special jigs. An exceptionally smooth exterior finish is achieved. Care has been exercised in the design to ensure that fatigue troubles, should they start, would remain localized and repaired after routine inspection in the normal manner. The nominal stress-level within the pressure-cabin structure (operating differential pressure equals 5½ lb/sq in) has been kept down to about 12,000 lb/sq in, and attention has been paid to all the details to ensure continuity and freedom from notches. A minimum factor of 3.0 has been applied to cut-outs, joints and other discontinuities. Cabin windows are so installed as to allow differential movement between transparency and structure.

The entire under-surface of the wing has been kept free from cut-outs so far as was possible, and the stress level under ultimate loads has been kept low consistent with the latest available S/N curves for well-designed joints.

Fuel System.—Normal fuel capacity is 1,130 Imp. gal, carried in integral tanks outboard of the engines. Normally each tank feeds its own engine, but a cross-feed ensures that either engine can be fed by either tank. There is provision for extra tankage outboard. Refuelling is accomplished either under pressure, through under-wing pressure refuelling valves, or by gravity feed through the over-wing refuelling cap. Fuel contents are measured by Smiths Waymouth gauging system. Dipsticks are fitted and the fuel pumps are designed to be changed without draining the tanks.

Hydraulic System.—The hydraulic system provider power for undercarriage retraction, wheel brakes, nosewheel steering and flap movement, and for the hingeing of the fuselage nose where this is specified. Hydraulic power is supplied by two engine-driven Lockheed hydraulic pumps. The main reservoir is located above the pumps, isolated from the pressure cabin above the wing. Normal operating pressure is 3,000 lb/sq in, regulated by an automatic cut-out valve, which in turn is protected by a relief valve. The by-pass from the cut-out passes fluid direct to the reservoir, the fact that it is not connected to the service return lines preventing the build-up of back pressures. Ground-servicing connections are fitted with Lockheed-Avery self-sealing couplings.

A single primary power accumulator is fed directly from the main pressure line; separate accumulators are provided for wheel brakes and emergency lowering of the undercarriage. The main power accumulator is designed to supply any service, the other accumulators providing duplicated sources of pressure in the event of failure; the operation of brakes and undercarriage retraction even in the event of double pump failure is thus assured. The accumulators, four in number, are compactly mounted on a readily accessible panel in the port wing root.

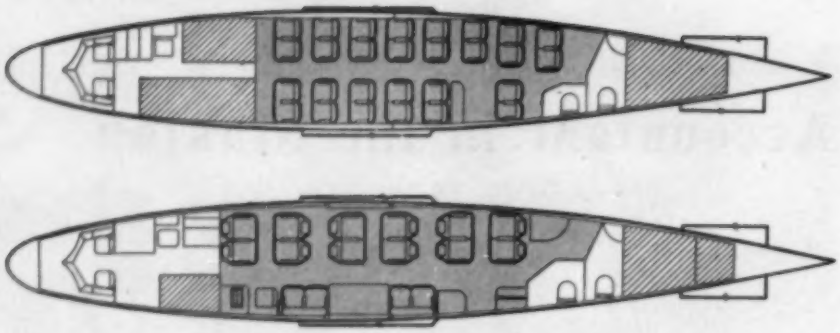
Downlocks for both nose and main undercarriage are of the internal type, and when the undercarriage is extended the jacks act as drag struts. Uplocks are external.

Nosewheel steering, of Dowty design, is accomplished through a manually operated steering valve controlled by handwheel. Control of the wheel braking system is by toe action on the rudder pedals, and differential braking is provided. The installation of anti-skid units is optional.

The wing flaps are hydraulically operated by two jacks.

Electrical System.—The electrical system is operated at 28

ACCOUNTANT IN THE MAKING . . .



(Upper plan) The standard 28-seat airliner version; a high-density variant accommodates up to 36 people. (Lower) The 12-seat luxury-executive version. Shaded areas indicate floor-area available for freight and baggage.

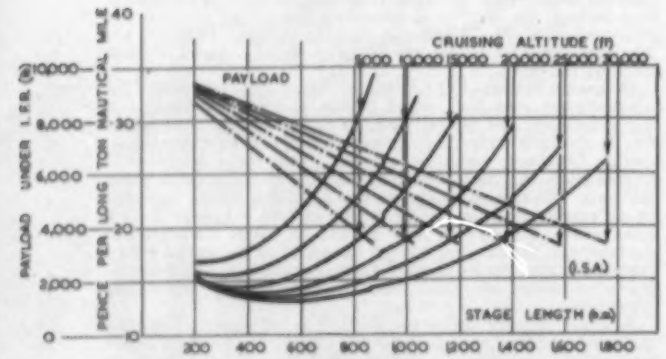
volts D.C., working on the earth-return system, and is supplied by two D.C. generators automatically regulated at 28 ± 0.5 volts, the output being paralleled. Four 24V 25-amp-hr batteries are installed providing sufficient capacity for internal engine starting, if necessary, and they are so arranged that, in an emergency, they provide a secondary source of D.C. power. One of the four batteries operates the vital services *via* a crash switch in an emergency. Power for flight instruments, autopilot and V.O.R./I.L.S. is provided by three 115-volt 400 c.p.s. rotary inverters. To provide an alternative source of power for flight instruments, change-over switching is used for the autopilot and flight instrument inverters. Two 208-volt engine-driven alternators provide power for the electrical de-icing of engine intakes, airscrews and windscreen.

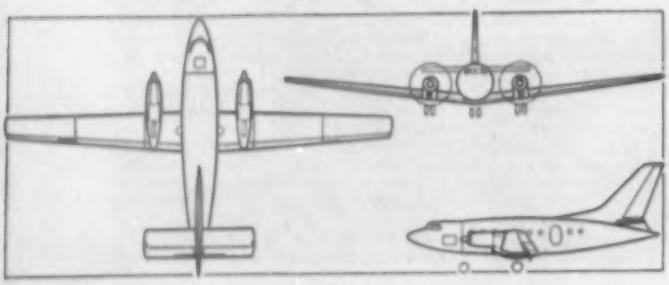
Radio Equipment.—Provision is made for the following: duplicated V.H.F. transmitter-receiver; H.F. transmitter-receiver; M.F. receiver; A.D.F.; I.L.S./V.O.R.; intercommunication; Decca Navigator; and a flight director system. With the exception of H.F. and A.D.F. all aerials are of the suppressed type. The V.H.F. aerial is of the fan type mounted in the fin, and glide-path, localizer and V.O.R. are slotted-type aerials mounted in the nose. A.D.F. loop and I.L.S. marker are fitted in the wing fairings and a "towel rail" is used for the A.D.F. The H.F. has the normal "washing line" between fin and fuselage.

ACCOMMODATION

Crew Compartment.—The normal crew door is on the forward port side of the fuselage; an emergency exit is located in the roof of the control cabin. The main instrument panel consists of the customary blind-flying instrumentation laid out to conform to accepted standards. It seems that a normal operating crew of three (two pilots and a radio navigator) would be carried, the latter in his own compartment behind the pilots.

Range-payload and range-cost curves for the Accountant, assuming a take-off weight of 28,000 lb, Dart cruising r.p.m. of 13,600, and an annual utilization of 2,000 hr. Costs are by the S.B.A.C. method.





Airliner Version.—Standard seating is for 28 passengers, although there is considerable flexibility of choice up to 36 passengers. The accompanying accommodation diagram shows the standard 28-seat version, which can be enlarged to accommodate up to 36 passengers at the expense of some toilet and freight accommodation. Accommodation for luggage is provided fore and aft of the passenger cabin.

A mixed passenger/freight version is offered, with a movable partition separating freight from passengers. In this variant, passenger seats may be folded to the cabin side for the accommodation of further freight by removing seat attachments.

The floor of the passenger compartment is made up of separate detachable sandwich panels. The centre portion of the floor is readily removable to afford inspection of underfloor services without removing the seats. The makers emphasize that accommodation layouts are intended to suit customers' particular requirements, and arrangements can be made for a set of floor panels to suit a number of alternative arrangements.

Executive Version.—An exceptionally well-appointed variant of the Accountant accommodates up to 12 people: the accompanying illustration is of a typical layout. From the outset, special attention has been given to the executive rôle of the Accountant, and it is likely that the extra volume available for fuel tankage in the outer wings is of particular advantage. Provision is made for up to 1,280 Imp gal. Accommodation is in six fully reclining double chairs on the starboard side of the aircraft, and provision can be made for four additional chairs facing inboard, giving passengers an alternative choice of seating in flight. Special furnishing includes a fitted desk for a secretary, an ample cocktail and refreshment cabinet amidships, and a wardrobe with fitted shelves aft. Alternative positions for the galley are at either extremity of the cabin.

Freighter.—In addition to the mixed passenger/freighter version described above, two special designs are offered: (a) with power-operated hingeing nose (the structure is engineered in such a way that variation from the normal fixed-nose aircraft can be accomplished by the fitting of three hinges and throw-over self-centring catches); and (b) with fixed nose, but with a large loading door on the forward port side of the fuselage, enabling cargo 3½ft by 3½ft by 3ft to be loaded.

Both (a) and (b) are available with full pressurization and air conditioning. If required, additional facilities include a hinged loading ramp and floor stressing to 150 lb/sq ft.

Air Ambulance Version.—Provision can be made for 17 stretchers with four sitting patients and two attendants. Other combinations are, of course, possible. Ample space is available for special medical equipment.

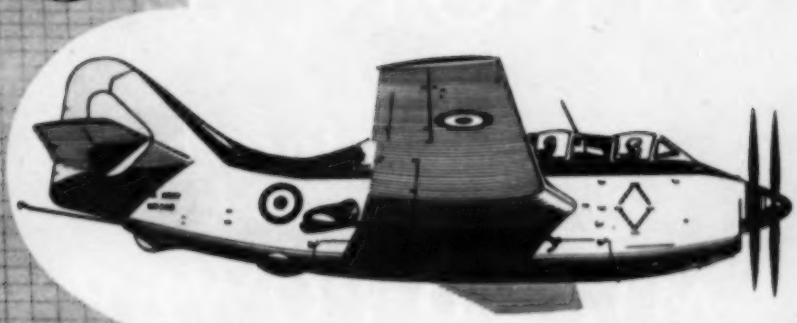
Consideration has been given during design to the possibility of other variants to widen the appeal of the Accountant, including photographic and geological survey versions.

AVIATION TRADERS ACCOUNTANT
(Two Rolls-Royce Dart RDa.4)

Span, 82.5ft; length, 60.5ft; height, 24ft; wing area, 632 sq ft; aspect ratio, 10.77; wing loading (max.), 44.3 lb/sq ft; power loading (take-off), 8.08 lb/h.p.; tyre pressure 55 lb/sq in.

Weights and Performance

Maximum take-off weight	28,000 lb
Maximum landing weight	27,000 lb
Maximum zero fuel weight	26,500 lb
Empty weight (28-seater)	14,823 lb
Crew and stewardess	540 lb
Operators' services	277 lb
Basic operating weight	15,640 lb
Normal disposable load (28 passengers and luggage at 200 lb each)	5,600 lb
Fuel	6,760 lb
Total	28,000 lb
At cruising weight of 26,000 lb, cruising speed at 25,000ft	284 m.p.h.
At take-off weight of 28,000 lb, maximum stage-length (at 25,000ft)	1,808 miles
Equivalent stage speed	270 m.p.h.
Equivalent stage time	6.7 hours
Rate of climb at sea level	1,532 ft/min
Service ceiling (rate of climb 100ft/min)	34,000ft
Operating altitude on one engine (13,800 r.p.m.)	12,000ft
Take-off distance to 50ft both engines (I.C.A.O. standard)	2,690ft
Take-off field length (one engine cut at critical speed)	3,050ft
Landing field length	2,950ft
Stalling speed flaps up (28,000 lb)	111 m.p.h.
Flaps take-off (28,000 lb)	95 m.p.h.
Flaps landing (27,000 lb)	75 m.p.h.



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a liquid-propellent rocket engine developing its maximum power at altitudes beyond the scope of air-breathing engines.

THE DE HAVILLAND ENGINE COMPANY LIMITED

Aerodynamically one of the cleanest helicopters yet built, the Cessna CH-1 (left) is claimed to be able to hover at heights in excess of 15,000ft while carrying two people. With a load increase of 400 lb its hovering ceiling is 11,000ft. Top speed is 122 m.p.h. at sea level. Taking off beyond the CH-1 is a Martin 404. The second picture shows a North American B-25 Mitchell of the R.C.A.F.

AIRCRAFT INTELLIGENCE

Great Britain

Gloster Javelin Development. Characteristics attributed by *Aviation Week* to this forthcoming all-weather fighter include Bristol Olympus turbojets and a redesigned, thinner wing. It is stated that the thickness/chord ratio of the wing will be high at the wing/nacelle intersection, change rapidly to a low value, and then stay constant to the tip. The Olympuses will be "handed" in order to power a single midships accessory section.

U.S.A.

McDonnell F-101 Voodoo. Three versions of this long-range single-seat supersonic fighter are the subject of a $330 m contract recently placed by the U.S.A.F. and bringing McDonnell's backlog to $601 m. The first machines to be built under the contract will be F-101B long-range intercepters, destined for Air Defense Command. The number of F-101A long-range escort fighters to be produced for Strategic Air Command is increased, as is the number of RF-101A photographic reconnaissance variants.

Douglas B-66. This U.S.A.F. light-bomber development of the A3D Sky-warrior is rumoured to be proving less successful than its naval counterpart. One has, nevertheless, arrived at Kirtland A.F.B. Special Weapons Centre, New Mexico, for tests.

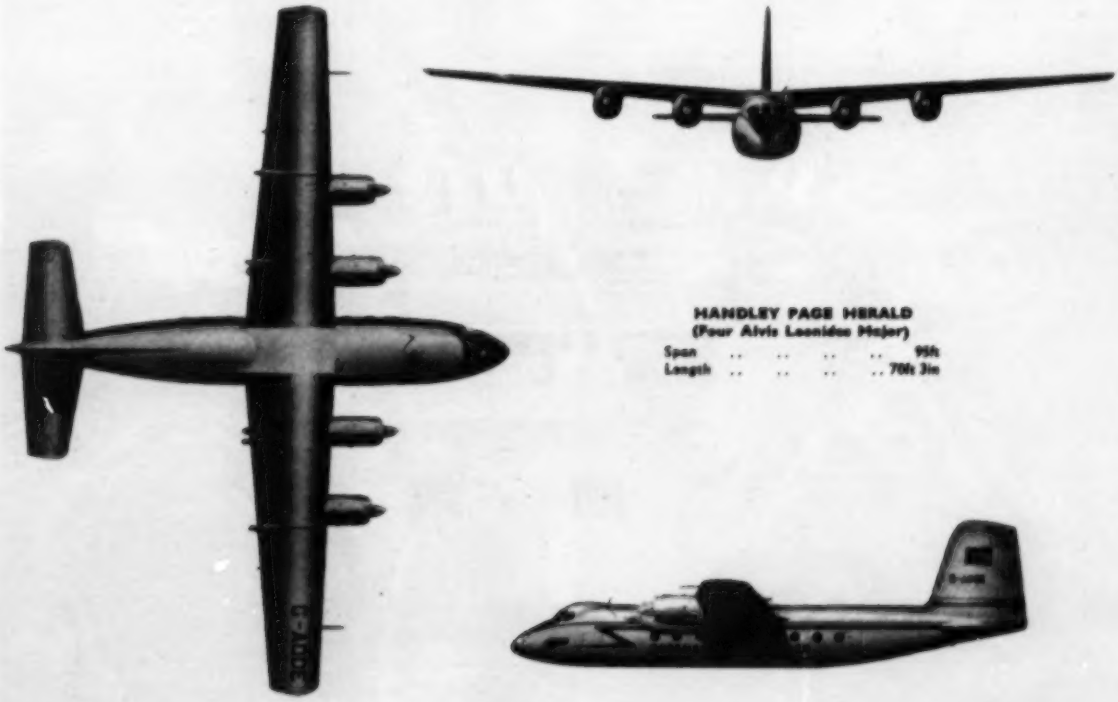
France

S.O.4050 Vautour. The spring of 1957 is the date now given for the first deliveries of Vautour light bombers to the French Air Force. Some months previously the first all-weather fighter variants and tactical support versions will have been handed over.

Bréguet 763 Deux-Ponts. The Bréguet works are preparing for the production of a new series of Deux-Ponts to meet an order now under negotiation, with a view to establishing two heavy transport groups for the French Air Force. The creation of these groups has been provided for in the 1955 budget. It is said that the decision was largely based on the Deux-Ponts' three years of trouble-free service with Air France, and on transport and parachuting tests, including heavy-dropping.

U.S.S.R.

Il-20 Transport. It can now be confirmed that the Il-20 transport, used for delivering high-priority cargoes, including newspaper matrices, on Aeroflot internal services, is a straightforward conversion of an Il-28 light bomber. The gun ports have been faired over but the bomb-bay doors are retained.



HANDLEY PAGE HERALD
(Four Alvis Leonides Major)

Span	..	..	..	..	95ft
Length	..	..	..	..	70ft 3in

Ratings stand by as Capt. Combell welcomes visitors to "Ark Royal." Although intended primarily for entertainment, the ship's private TV system could be used to speed aircrew briefing.

ATOMIC-AGE CARRIER

A Visit to H.M.S. "Ark Royal" : Ultra-modern Equipment Above and Below

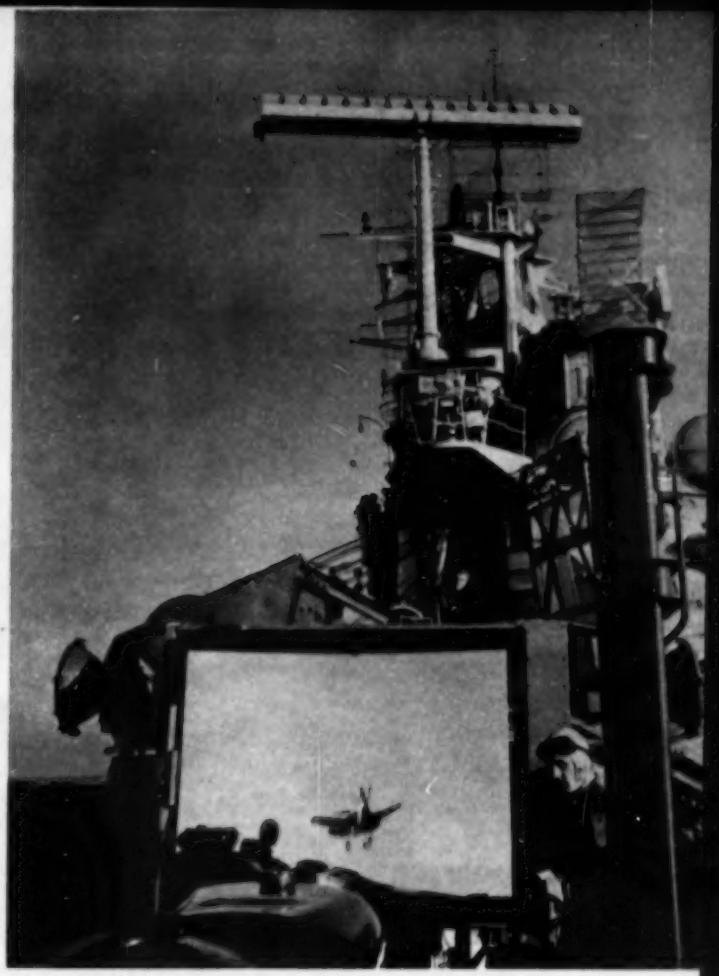
SUBJECT of the photographs on these pages, H.M.S. *Ark Royal* is the Royal Navy's latest and greatest aircraft carrier. Her overall length of 808ft 3in is 4½ft more than that of her "small sister" H.M.S. *Eagle*, and she has a displacement of 36,800 tons. But mere size and weight tell only half the story because, ultimately, a carrier's worth is measured by the spirit and skill of those who man her, and by the quality of her aircraft.

One has only to step aboard *Ark Royal* to know that her complement of 2,200 officers and ratings disagree violently with the chairborne strategists who condemn carriers as obsolete and ineffective in an age of nuclear bombs and guided weapons. They are very conscious of the fighting tradition they have inherited, and the battle honours of three previous *Ark Royals* are displayed on the flight deck and quarter-deck. They are also immensely proud of their own ship, which is the first carrier in service that has been built to fight an atomic war.

Her mod. con. are not restricted to the externally apparent 5½-degree angled deck, two steam catapults, mirror landing aids and side lift. In one respect at least, she appears to be nearly 30 years ahead of her time, for Captain D. R. F. Cambell, R.N., welcomed a party of journalists aboard his ship by television, in the manner of "Big Brother" in George Orwell's prophecy of life in 1984!

No mere stunt, the *Ark's* closed-circuit TV system was obtained by "private enterprise" so that films and live entertainment could be relayed simultaneously to the crew in messes dispersed

Helicopter view of the stern of "Ark Royal," with Sea Hawks, Skyraiders and Gannets ranged on the rear of her flight deck.



Immediately before touchdown, a Gannet of 824 Squadron is caricatured in one of the ship's mirror landing aids.

throughout the ship. At present there are six receivers; more will be bought when the ship's funds, or gifts, make it possible. Some financial aid may come from the Admiralty, because the system has obvious operational applications. A single briefing crew could, for example, address aircrew in the three widely-separated briefing rooms from the ship's small TV studio on No. 4 deck, without any fear that their broadcast would be picked up by outside receivers.

An even more important innovation is that *Ark Royal's* main propulsion machinery can be controlled entirely from two air-conditioned remote control rooms on No. 6 deck. Each of these rooms is linked with the machinery driving two of the ship's four shafts, through a simple hydraulic system which reduces the usually complex controls to a neatly laid-out bank of levers and dials.

The idea is that, if the vessel should be within the fall-out area of an atomic attack, she could be sealed immediately to prevent outside air and spray being drawn into her air-conditioning system. Without ventilation, the atmosphere in the engine rooms would quickly become unbearable: so they would be evacuated and the ship controlled from the remote control rooms to get her out of the danger area as quickly as possible.

The efficiency of the system was proved recently, when the vessel was brought to anchor in Sandown Bay, off the Isle of Wight, entirely under remote control, with nobody in the engine rooms.

At the time of our visit to the carrier, her squadrons had been embarked for only one week and were still settling down: but this was not apparent in either the deck operations or the wardrooms. The "bird-men" and "fish-heads" clearly have a high opinion of each others' capabilities, which is essential if any ship is to be happy and efficient.

Ark Royal is not perfect. Ideally, her deck should be angled at 8½ deg to ensure maximum fighting efficiency: and her side-lift should have been on the starboard side, instead of in its present position, where it forms part of the angled deck and so cannot be operated while aircraft are landing-on.

This reflects the fact that the ship was laid down 12 years ago, before her present captain had devised the angled deck concept. Completion was delayed to incorporate the 5½-deg deck, which offers much greater safety during flying operations; but it was not considered practicable from either the financial or the time aspect to make the major constructional changes that a fully angled deck would have entailed. Even in her present form, *Ark Royal* is reputed to have cost over £20 million.

Aircraft so far embarked are No. 800 and No. 898 Squadrons (Sea Hawk fighters) commanded by Lt-Cdr. R. D. Lygo, R.N., and Lt-Cdr. J. H. S. Pearce, R.N., respectively; No. 824 Squadron (Gannet anti-submarine aircraft) commanded by Lt-Cdr. J. D. Honywill, R.N.; and "B" Flight of four Skyraider early-warning aircraft from No. 849 Squadron, commanded by Lt-Cdr. R. C. Ashworth, R.N. *Ark Royal* should also have two squadrons of Sea Venom all-weather fighters, but they have arrester-hook trouble and the ship had to sail for the Mediterranean without them on October 11th.

While we were aboard the ship, her aircraft continued their working-up programme, which showed that they have already achieved a high operational standard. The formation flying of Nos. 800, 824 and 898 Squadrons was impeccable; the formation aerobatics by a flight of four Sea Hawks of No. 800 Squadron, and individual demonstrations by a Sea Hawk and a Gannet, were good even by "Farnborough" standards. The speed and efficiency of deck handling was no less commendable, despite a spot of bother with the starboard steam catapult.

One is left with a host of tangled impressions after so short a visit to so vast and complex a ship—of seemingly endless miles of corridors and innumerable ladders linking the ten decks; the utter cleanliness and smartness of even the engine rooms; an electrically-operated roll-moulder which converts a lump of dough into the perfectly-shaped raw material for dozens of bread rolls in a few seconds; the immensity of the two hangar decks; and occasional incongruities such as the sight of a very ancient London taxi (serial number CUV 177) which the squadron commanders use for joy-riding during shore leave.

Most impressive of all was to stand on the quarter-deck towards sunset as *Ark Royal* speeded at 25 knots towards Spithead. Under her flat stern, the four screws threshed the water to a white frenzy. On each side, mountainous green waves curved away from the smooth welded hull. Here was that combination of beauty and power that man can achieve only in a great ship. J. W. R. T.

Formation flying by "Ark Royal's" Gannets (left) was impressive in its precision. (Right) Steam-catapulting a Sea Hawk.

The B.E.A. specification required that the Vanguard be "aesthetically pleasing." This requirement has assuredly been met.

INTRODUCING THE VANGUARD

Vickers Announce the New V.900 Airliner—and Fresh Viscount Orders

FIRST details of a completely new turboprop transport, the Vickers V.900 Vanguard, were announced jointly last Monday, October 17th, by Vickers-Armstrongs, Ltd., and British European Airways. The B.E.A. announcement said that the airline was "in negotiation with Vickers-Armstrongs" for a fleet of Vanguard airliners designed for delivery in 1959-60.

That B.E.A. have decided to place a firm order for Vanguards is certain, though it appears that the Corporation has not yet obtained the formal Treasury approval which must precede the signing of a contract. It is believed that B.E.A.'s initial order will be for 20 Vanguards, with an option on five more. Simultaneously, it was announced that B.E.A. had informed Vickers of their intention to place orders for additional Viscounts in the V.800 series.

Basic price of the Vanguard, it is expected, will be in the region of £750,000. Until last Monday, no details of the project had been given to airline operators other than B.E.A. Every effort will now be made, however, to attract orders from abroad.

As expected, the power-unit selected for the new Vickers transport is the Rolls-Royce Tyne (RB.109) turboprop, described and illustrated on page 638 of this issue; on the same page, first details are given of the Dart RDa.7, a more powerful development of the Viscount's engine.

Vickers-Armstrongs emphasize that the Vanguard is not a successor to the Viscount, but an addition to a range of turboprop airliners designed to meet a variety of airline requirements. The makers believe, in fact, that the V.700-800-900 series are capable of meeting all major requirements other than those of operators of the very longest routes, such as the North Atlantic. Essential characteristics of the three members of the Vickers turboprop family are as follows:—

V.900 Vanguard: 93/105-seater for very high-density routes, cruising at 400-425 m.p.h. on stages varying from 500 to, ultimately, 2,500 miles.

V.800 Viscount-Major: 65/70-seater with increased freight-capacity for shorter, high-density routes. With capacity payload, it will operate sectors of about 750 miles. Dart RDa.7s will give the Viscount-Major a speed of 360 m.p.h.

V.700D Viscount: 40/53-seater for medium-stage routes, capable of carrying its capacity payload on sectors of 950 miles. Use of Dart RDa.7s in place of the RDa.6 (Mk 510) engines specified for current production Viscounts will increase the recommended cruising speed from 328 to 360 m.p.h. Installation of a still later model Dart—presumably the RDa.8—will increase the cruising speed of both versions of the Viscount to 400 m.p.h.

Operator and manufacturer describe the background to the Vanguard in the following terms:—

B.E.A.: "It is being designed to meet a detailed B.E.A. Specification of Requirements drawn up by the Corporation earlier this year as a result of two years of detailed analysis and discussion. This B.E.A. Requirement calls for an airliner which 'will set a new world standard in its class and will be ahead of all known competition in reliability, speed, economy, comfort, pilot handling, maintenance characteristics, ability to make quick turnrounds and in general passenger appeal.'

"The specification supplied by B.E.A. to Vickers-Armstrongs (Aircraft), Ltd., is believed to be the fullest statement of detailed requirement ever given by an airline operator to a manufacturer and ran to more than 50 pages. Throughout the design period there has been the closest possible degree of co-operation between B.E.A. and the manufacturing firm.

"In the opinion of B.E.A. not only will the Vickers Vanguard set new standards of speed and economy, but it will also fully meet the requirement for a passenger comfort and spaciousness not hitherto attained by an airliner of any type whatever."

Vickers-Armstrongs: "This big new aircraft is the logical 'third man' in the Vickers family of propeller-turbine airliners. It offers great carrying capacity for the busiest of the high-density routes, and, at the same time, has a development potential which will enable it to operate on long ranges of up to 2,500 statute miles sector distance.

"The Vickers 900 has, in its B.E.A. form, been designed as a result of a most detailed specification supplied by B.E.A. This specification was based on that Corporation's great experience of propeller-turbine operation coupled with the fullest appraisal of the traffic trends and requirements for the 1960s. Some evidence of the care and planning effort which have gone into the new aeroplane may be gained from the fact that 60 separate design studies were made of the Vickers 900 Project before it was finalized as meeting the detailed airline requirements for the big turboprop of the future."

As shown by the illustrations, the Vanguard will be of pleasing but basically conventional shape. The design might, however, be described as having "built-in stretch"; that is, full allowance has been made at the drawing-board stage for translating improved engine performance into increased range, speed or payload with a minimum of airframe redesign or modification. Vickers thus hope to produce a design of wider application than any previous large airliner—one capable of operating with maximum economy on any sector of between 200 and 2,500 miles in length. It is the company's belief that 86 per cent of all air services operated at present lie within this band of stage-lengths.

As specified by B.E.A., the Vanguard will be a 93-passenger airliner carrying its maximum payload of 21,000 lb on sector distances of 500 miles. Initially, with the output of the Tyne limited to 4,000 h.p. each, the cruising speed will be 400 m.p.h. The design cruising speed required by the specification, with the engine giving increased power, is 425 m.p.h. The development programme laid down by Vickers envisages great increases in range and gross weight (the basic B.E.A.-style Vanguard will probably begin life at 110,000 lb) in order to widen the application of the aircraft. An ultimate sector-capability of 2,500 miles with 90 passengers is foreseen; the relevant cruising speed would be "at least 400 m.p.h."

Most of the preliminary information released on the Vanguard deals with the layout of the fuselage; few details are yet available of structure, systems, undercarriage, weights or performance.

A "double-bubble" section has been chosen for the fuselage, the upper deck being used for passenger accommodation and the lower for two unusually large freight compartments. The overall length of 117ft 10in is exceeded by only one transport now building: the Britannia 300. Of this length, an unusually large proportion is usable.

The large freight compartments enclosed in the lower "bubble" of the fuselage represent one of the most important features of the aircraft, since they will enable it to carry a full (weight-limited) payload with only 30 per cent of seats filled. Volumetric capacity should never be a limiting factor with the Vanguard. Its flexibility as to type of payload carried should have an important effect on the economics of B.E.A.'s highly seasonal routes. Large doors and a working height of 4ft 6in will make loading of the Vanguard's freight holds an unusually simple procedure.

In the standard B.E.A. layout, shown in the accompanying diagram, 93 passengers will be accommodated in three separate compartments. With two pantries, two cloakrooms, a bar and four toilets, this version of the Vanguard should provide B.E.A.'s passengers with a standard of comfort normally encountered only on first-class inter-continental services. There are two passenger-entrance doors, each equipped with folding "air stairs" for faster and more economical passenger loading. The absence of "carry-on" luggage bays is perhaps surprising, in view of their success on short-haul routes in America and, to a lesser extent, in Europe.

The B.E.A. layout is capable of conversion into an 85-seat "mixed-class" interior without alteration of galley, bar, cloakroom and toilet positions; this would be achieved by the addition of an extra bulkhead dividing the central cabin. Forward of this bulkhead, 45 tourist passengers would be accommodated, 40 first-class seats taking up the remaining compartments.

From the top: V.900, V.800 and V.700, to similar scales. The new transport has roughly twice the usable volume of the V.800, and a longer cabin than any airliner at present operated anywhere in the world. Inner nacelles are bulged to house the forward-retracting main undercarriage units, and the outer jet-pipes pass under the wing.

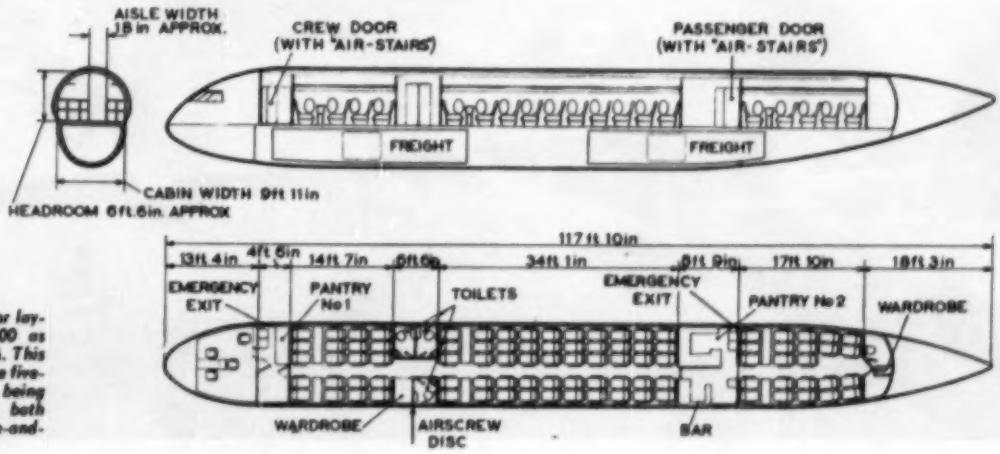
The elliptical windows which have proved so popular with Viscount passengers have been retained on the larger aircraft, which has 19 on each side of the fuselage. No windows are fitted in the plane of the airscrews, which should considerably ease the weight-penalty of effective soundproofing in this area and result in an extremely quiet cabin. Wardrobe and toilet positions can therefore be regarded as permanent fixtures, except in a very-high-density version.

The five-abreast seating arrangement employed in B.E.A.'s Viscounts is retained in the B.E.A. version of the Vanguard, and seats are pitched at 39in in both types.

The Vanguard's fuselage is, of course, pressurized—to the same differential pressure (6½ lb/sq in) as the Viscount; this provides for a cabin altitude of 5,000ft at an actual height of 25,000ft. The heating system will maintain the cabins and the crew compartments at 70 deg F at an altitude of 30,000ft and an outside air temperature of −76 deg F; under the same conditions, the freight compartments can be maintained at +35 deg F. The refrigeration system will maintain a 70 deg F temperature for crew and passengers at an outside air temperature of 95 deg F with 65 per cent relative humidity.

Thermal de-icing is to be fitted to the mainplanes, heat coming from heat exchangers fitted in the engine nacelles, and the tail unit will have an electrical de-icing system. Provision will be made for all contemporary radio and radar aids, including weather radar.

Vickers state that the Vanguard "will come straight into production." First production aircraft will be ready for delivery in the spring of 1960, and over half the number earmarked for B.E.A. will have been delivered by the end of that year.



Provisional interior lay-out for the V.900 as specified by B.E.A. This shows 93 seats, the five-abreast layout being comfortable in both lateral and fore-and-aft planes.

Looking-in on Vickers-Armstrongs

IT is an excellent thing that the accredited representatives of other nations should be enabled to see for themselves how Britain's air effort is mounting; and of no production line are we in this country more proud than the Vickers-Armstrongs Viscount line at Hurn, near Bournemouth. Recently sixteen air attachés saw this for themselves, and four of the party are grouped on the left with a Capital Airlines Viscount and Mr. Charles Gardner—assistant to the managing director of Vickers-Armstrongs (Aircraft), Ltd. Left to right, the attachés are Lt-Col. Pribyl (Czechoslovakia), Col. A. I. Marakazov (U.S.S.R.), A. Cdre Prasong Kunadilok (Thailand) and Lt-Col. S. Kazmierski (Poland). On the extreme right is S/L. M. K. Forter, an R.A.F. liaison officer.

The large pictures on this and the opposite page show, for the first time, production at Weybridge of the Valiant B.1 medium bomber. Production flow is now "substantial". Each Valiant is flown out from the 1,280-yd runway at Brooklands for its full programme of flight trials at nearby Wisley. The air-to-air picture shows a Vickers-Supermarine Swift F.R.5 as now in production for the R.A.F. at Eastleigh, Itchen and South Marston.

JET-FLAP DEVELOPMENT

N.G.T.E. Aerodynamicist's Lecture before the Royal Aeronautical Society. Part I

DEMONSTRATED by the Ministry of Supply at this year's S.B.A.C. Show, and described in *Flight* of September 30th, the jet flap was the subject of an R.Ae.S. lecture given by Mr. I. M. Davidson, B.Sc., A.F.R.Ae.S. (of the National Gas Turbine Establishment) in London yesterday, October 20th. We give here a condensed report of the first part of Mr. Davidson's paper, concerned with basic principles and illustrated by Crown Copyright diagrams. Part 2 of the paper, *Some Aeronautical Considerations*, will be reported in next week's issue.

"In human and avian flight near the ground there are a great many differences," Mr. Davidson stated in his introduction, "but of these only two appear vital—that the bird sports a complete mastery over the stall while, with its relatively low wing loading, it can fly much more slowly. In all species flight is naturally a means to an end and for that reason practical aviation is, and always will be, tied to wing loadings of about a hundred times those of the birds. Thus, for a bird-like performance to be possible, one obvious necessity is a means for the generation and control of very high lift coefficients—higher perhaps than anything which has previously been considered possible. The other is, naturally, the removal of the danger of the stall.

"In recent years, a possible practical solution of just those difficulties has apparently emerged. This is the jet flap, which depends upon nothing more than the aerodynamic resynthesis of the lifting and propulsive means, the entire propulsive jet being ejected in the form of a thin, full span sheet from the trailing edge of the wing. Although novel, the underlying physical principle is by no means new, for it is commonly found as a side effect in experiments on boundary layer control by blowing over the top surface of a trailing edge flap. Indeed, in that guise it enjoys world wide recognition, the American term being supercirculation and the French, hypersustentation.

"The first published information was that contained in a paper written by Hagedorn and Ruden at Hanover in 1938. In France the discovery was made independently, the first trace being an unpublished paper written in 1942 by Valenci, Parigi and Borgel at Marseilles. The first relevant French publication was by Poisson-Quinton in 1948 while, as recently as December 1954, Jousserandot has described the results of extensive experiments in which the active principle was all but isolated.

"In the U.S.A. the effect was demonstrated as early as 1931 by the early results of Bamber, but there, as elsewhere, the emphasis was on the use of the jet for boundary layer control. The British trail is again a long one for, at the Royal Aircraft Establishment, the subject was broached by Lyon, Barnes and Adamson in 1941, and again by Mettam in 1951.

"However, in all the early works the vital principle seems to have been considered mainly as a scientific curiosity, and the crucial step was not taken until November 1952. That step was the observation by Constant that, the propulsive jet of a modern aircraft being a very powerful physical entity, it should be one hundred per cent combined with the wing in flight near the ground."

Turning to the basic principles of the jet flap, the lecturer considered first the lift on a two-dimensional wing. "Basically," he submitted, "the gas stream from a jet flap acts just like a large Fowler flap. It baulks the lower mainstream, forces it over the wing and so, following Bernoulli, aerodynamic lift is generated. This argument is simple enough, but it implies that the jet path is already known; that there is in fact a worthwhile downward penetration of the mainstream. Among other things, the effect must clearly depend upon the speed of the aircraft and the setting of throttles so that there is, as with the ornithopter, some inexorable combination of the lift and the thrust. To discover the laws of that combination it is best to consider the mechanism in two-dimensional flow."

Mr. Davidson next described the N.G.T.E. demonstration equipment used. The bulk of the early work, he said, was done on an elliptical aerofoil having three separate trailing edges, with respective jet angles of 31.4, 58.1 and 90.0 deg (see Fig. 1).

In the basic aerodynamic mechanism (Fig. 2), it was essential to distinguish between the engine thrust or total jet reaction (J) and the reaction thrust of ($J \cos \theta$) on the aerofoil, the lecturer continued. "Since, with or without mixing, the jet must be turned to flow parallel to the flight path and since it carries everywhere a momentum flux equal to J, each of its elements must exert a centrifugal force as shown. In turn, this force is balanced by a difference of static pressure across the jet such that the total lift on its centre line is equal to $J \sin \theta$, the original downward momentum flux. In the theory use is made of the idea of an analogous structural flap (shown dotted) and, from the size which this can assume, it will be seen that very high lift coefficients must in principle be possible (Fig. 3).

"In practice it is best not to divide the lift into an aerodynamic or pressure component and a jet or reaction component, but rather to think in terms of the whole . . . From the diagram (Fig. 4) it will be seen that even the pressure or aerodynamic lift component is greater than could be generated by any other practical mechanism, while, beside the total, the idea of using only pure jet lift looks decidedly uneconomic. This last point is perhaps better illustrated by Fig. 5 in which the lift gain (G) is a direct measure of the total lift which can be generated per pound of available jet reaction. Thus, for many practical purposes the jet flap can be regarded simply as a jet lift amplifier of which the gain lies generally between three and thirty.

"In the present theory an empirical factor is involved in the estimation of the lift at zero incidence, so it would not be fair to

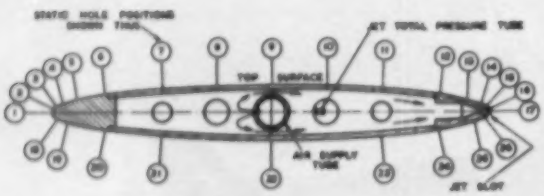
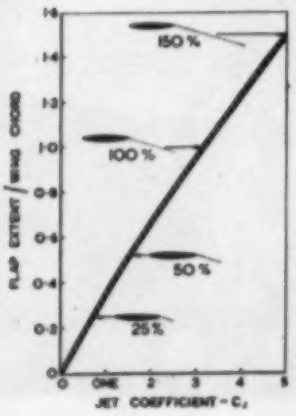


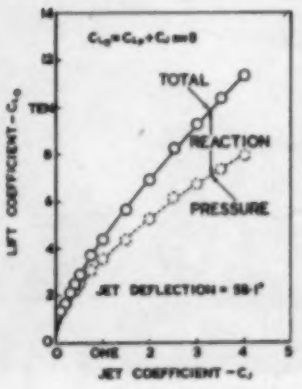
Fig. 1. Some details of the models.

Fig. 2 (below). The basic principle.

Fig. 3 (centre, below). The analogous flap size.

Fig. 4. Measured lift at zero incidence.





NOTE TO AIRCREW.

This test was carried out with a standard Mark 3 Ejection Seat fitted with a modified Time Release which is not yet incorporated in Service equipment.

On the 3rd September, Squadron Leader J. S. Fifield, D.F.C., A.F.C., was ejected from a Meteor Mark 7 whilst taking off from the runway at Chalgrove Airfield, Oxon. This is the first time in the history of world aviation that this feat has been performed, and no other ejector seat in the world can compare with this performance. This marks a red letter day in the history of escape from aircraft at ground level.

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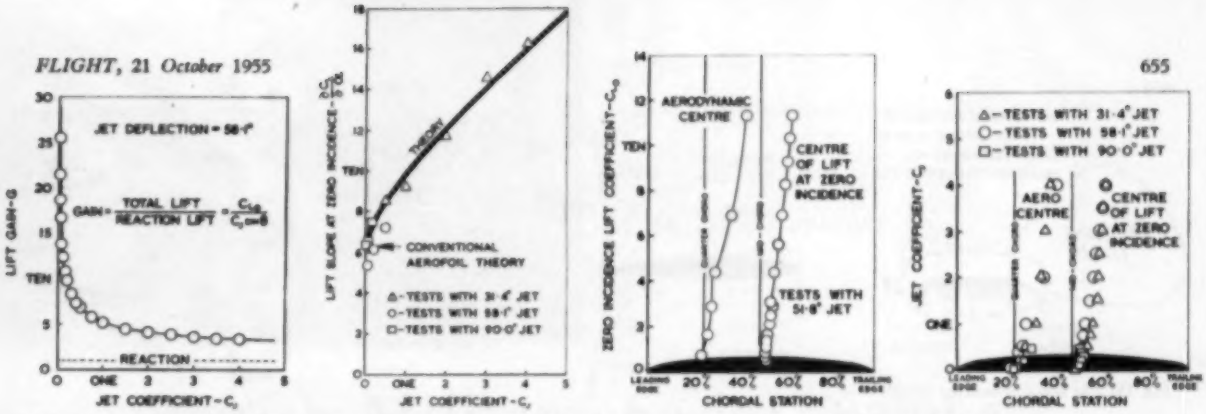
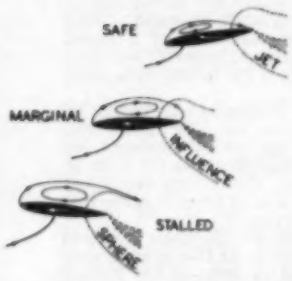


Figs. 5-8 (l. to r.). Lift gain at zero incidence; variation of lift with incidence; lift-centre positions; correlation with jet coefficient.

JET-FLAP DEVELOPMENT . . .

attempt a comparison with experiment. The lift slope, on the other hand, is almost independent of that factor and so, in Fig. 6, a comparison is made between the measured values and the theoretical curve for an undeflected jet on a thin aerofoil.

"For various reasons the conventional C_M—C_L curve is not a good way of showing up the pitching behaviour of a jet-flapped aerofoil, so in Fig. 7 an alternative presentation is adopted. In this diagram, which includes all the reaction effects, the total lift coefficient is plotted against the positions of the aerodynamic centre and the centre of total lift. Roughly speaking, the aerodynamic centre is at the quarter chord point and the centre of lift is at mid-chord, but for a given thrust they both move gradually aft as the air speed is reduced. Fundamentally, of course, C_J and not C_L is the basic variable, and in Fig 8 it will be seen that on this basis these two lift centres agree fairly well for all three jet angles."



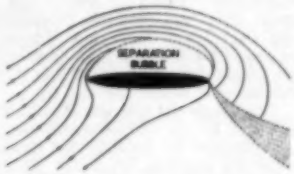


Fig. 9 (above). Formation of the separation bubble.

Fig. 10 (left). The stalling process.

Concerning stalling behaviour, the lecturer said that, whereas in a conventional aircraft the incidence provided the only significant control derivative, the lift on a jet-flapped wing could be altered at any incidence by changing either the jet angle or the jet coefficient. In practice, however, the situation was simplified because of undesirable effects due to large jet-angle variations under high-jet conditions.

"The second simplification," he went on, "is that it is manifestly impossible to stall a jet-flapped wing by increasing its thrust; C_L will go on increasing *ad infinitum* whatever the physical appearance of the flow. . . From Fig. 9 the reason can be seen to be the tremendous influence of the jet mixing entrainment effect. For example, from the undersurface flow it will be noticed that the mainstream is actually turned to meet the jet, and the extensive nature of this inflow produces a rather interesting result. As the thrust is increased the stagnation point moves steadily aft, but at very high lift it eventually stops and then moves forward again.

"That this entrainment process is also the key to the incidence stalling behaviour is suggested in Fig. 10, which depicts for the purposes of illustration a much simplified view of the real situation. In this view the entrainment effect is thought of as having a discrete sphere of influence. As the incidence is raised the separated mainstream is eventually thrown clear of this sphere, so that the bubble bursts to form an open wake; and this means a stall, that is, a reversal in the sign of the lift slope. . . .

"The experimental lift curves for the 31.4 deg model are shown in Fig. 11, in which the stalling envelope appears to asymptote to the vertical at about +4 deg incidence. Indeed, at a C_J value of 4.0 there is a suggestion of complete installability, but this should be treated with suspicion. In general, the lift curves do not curl over below +3 deg and, when it does occur, the severity of the stall increases with C_J. The envelopes for all three models are shown in Fig. 12, from which it will be seen that, even with large jet angles, there exists in principle the possibility of producing an unstallable aircraft, for the lift can be raised indefinitely without crossing the envelope.

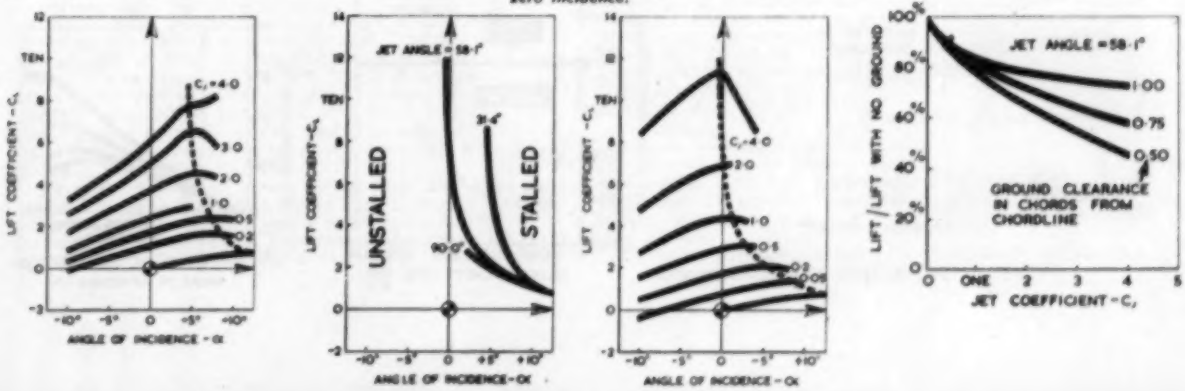
"The full results for the 58.1 deg model are shown in Fig. 13, where the lines will be seen to curve long before the stall. This is undoubtedly due in part to the greater volume of the separation bubble, but it is thought also to be connected with a substantial increase in the jet mixing losses."

The interference effects on a jet-flapped aerofoil, Mr. Davidson continued, were apparently different from those in a conventional system, for a substantial part of the lift-producing "structure," namely the jet itself, was grossly distorted by the presence of adjacent ground. Aerodynamically, the effects of this jet distortion were most fortunate, for they resulted in the loss of lift being only a small fraction of that with any other lifting system (Fig. 14).

Turning to the thrust of a two-dimensional wing, the lecturer began with the theorem that, in an idealized two-dimensional jet-flap system, the gross thrust was equal to the total jet reaction and was independent of the angle of deflection of the jet. Even in crude experiments with obvious losses, he said, a jet angle of 90 deg could easily yield a pressure thrust of between 0.3 J and 0.4 J. In an example (Fig. 15) the proximate cause was the substantial low-pressure region on the nose of the aerofoil.

"Since the apparent losses are due to the jet-mixing process," Mr. Davidson said, "they can fairly be described as jet drag. Again there are several ways of looking at the jet-drag mechanism, but of these the simplest is perhaps that of Fig. 16 in which the aerofoil is at rest. In the entrainment process the surrounding air is accelerated locally in the vicinity of the trailing edge, so producing a suction drag on the profile. In flight there is of course a similar effect, but the rate of entrainment and hence the drag

Figs. 11-14 (l. to r.). Stalling behaviour, 31.4 deg model; the three stalling envelopes; stalling behaviour, 58.1 deg model; ground effect, zero incidence.



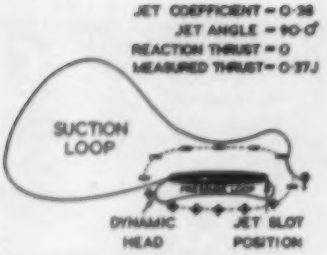


Fig. 15. The pressure-induced thrust.

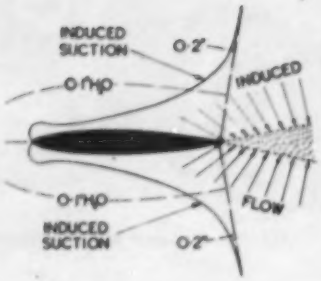
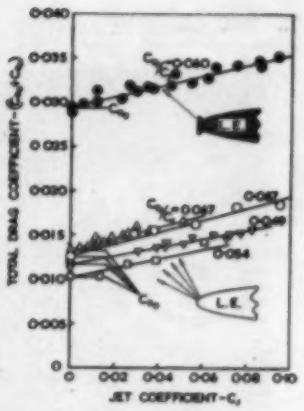


Fig. 16. The jet drag on an aerofoil at rest.

Fig. 17 (right). Drag of an undeflected jet.



JET-FLAP DEVELOPMENT . . .

then depends upon the jet velocity relative to the mainstream."

Some rough exploratory experiments were made with an undeflected jet issuing from an aerofoil having (due to its simple construction) a wandering transition point, the lecturer went on. "Thus, under nominally identical test conditions, a number of quite different drag curves was obtained (Fig. 17). The jet drag is given of course by the slope of these curves and, to make quite certain that there was no mistake, one test was made with a large leading edge spoiler fitted, as shown. The result is quite conclusive and it suggests that in cruising flight an aircraft with a cold propulsive jet must be expected to suffer from a jet drag which is equal in magnitude to some five or six per cent of the gross thrust.

"Since it is desirable in practice to use the same exhaust system at all times this last conclusion appears rather ominous, but fortunately there is one important variable which has yet to be taken into account—the density of the jet gas.

"It has just been shown that when the jet and mainstream densities are the same there is, in practice, an entrainment or a sink effect, while in classical aerodynamics the growing boundary layer or wake of an aerofoil can be simulated by a source effect. Hence, in such a system, the existence of sinks or sources, of a pressure drag or a pressure thrust, seems to depend upon whether the jet or wake velocity is greater or smaller than that of the mainstream. In a penetrating and markedly heuristic analysis, Strafford has shown that the real criterion is that of Fig. 18, that is, that the significant variable is not the relationship of the two velocities, but is the ratio of the density-velocity product to that of the mainstream. . . .

"In a confirmatory experiment the model was run with a pure hydrogen jet of which the thrust was progressively raised to give the result of Fig. 19. From the drag scale it will be seen that this experiment involved the measurement of very small differences, so on that account alone an accuracy of better than, say ± 10 per cent, could not have been hoped for. On top of this difficulty, because of cooling effects, there could be no guarantee that the model slot width was invariant with time. Nevertheless, by repeating the results under a number of slightly different conditions, sufficient evidence was accumulated to show that there was undoubtedly a region of low thrust in which the jet drag was negative, as illustrated."

Referring to take-off and landing, the lecturer said: "The magnitude of the jet drag has been shown to depend upon the strength of the entrainment effect and so upon the shear velocity between the jet and the mainstream fluids. As this shear velocity increases, so will the loss. Previously, it was seen that with large C_J values the lower mainstream does not even run straight into the jet but, near the nozzle, is turned to meet it head on. The violence of this initial mixing is thought to be one of the main sources of jet drag under high lift conditions and is why C_{DJ} must be expected to increase rapidly with the jet deflection angle.

"Since the jet drag must appear also as a loss of momentum flux in the mixed stream, there arises naturally the question of how this flux loss will affect the total lift on the system. On this point there is no direct evidence, but intuition suggests that a lift loss can be produced only by that mixing which occurs in the highly curved region of the jet before it turns parallel to the flight path. Thus even a large jet drag might correspond only to a moderate loss of lift and, in fact, this is borne out by the lift-incidence curves for the 58.1 deg model."

Turning to jet-flapped wings of finite span, Mr. Davidson pointed out that very little was known, the only available results being those obtained before the Second World War by Hagedorn and Ruden. From the results (Fig. 20) of this first jet-flap experiment, they had correctly diagnosed the active principle. Since the tests were done only during the calibration of a model intended for work on boundary-layer control, however, and since jet propulsion was presumably a thing of the future, these early results were never followed up.

"Although the reaction lift of a real jet-flapped wing cannot be affected by its three-dimensional nature, the total rather than the pressure lift must be the cause of the induced incidence, for even the reaction lift is felt by the mainstream in the form of a pressure difference across the jet sheet. Hence, very nearly, but not quite, the conventional formulae will be used in correcting the pressure lift for the effects of aspect ratio."

Concluding the first part of his paper, Mr. Davidson suggested what was possibly the best practical view in the case of finite-span wings, where the shed vorticity would go more or less directly into the jet so that it would never really appear as a tip vortex. This view was that "all real wings generate their lift by throwing down the mainstream, so that, if through its entrainment action a jet-flapped wing can get to grips with more than the usual mass flow, it must throw it down at less than the usual angle. With its relationship to the Froude efficiency of propulsion, this argument suggests also why the induced drag of a jet flapped wing will be substantially less than that of a conventional wing with the same conditions of loading. Just how much less it is not yet possible to say."

The remainder of Mr. Davidson's paper, entitled "Some Aeronautical Considerations," will be summarized in our next issue. It contains a review of some of the factors which must be taken into account in applying the concept of the jet flap to actual flying machines.

Readers may also recall our issue of September 30th, wherein appeared (in an article entitled "The Jet Flap") photographs of the N.G.T.E. models and a specimen photograph of the 58.1 deg model in the smoke-tunnel.

(To be concluded)

Fig. 18 (below). Effect of jet density.

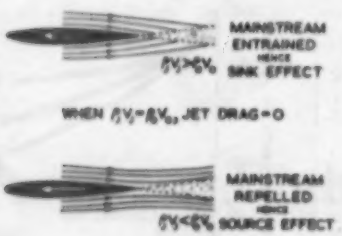


Fig. 19 (right). Hydrogen-test results.

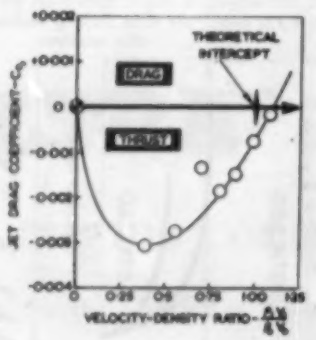
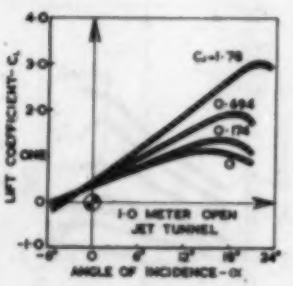


Fig. 20. The first experimental results.



A serial of 1913-14, on a B.E.2a of No. 3 Sqn., Royal Flying Corps.

A 1912-1955 History

By R. C. STURTIVANT

British Military Serial Numbers

THE first practical use of military aircraft in this country was in 1912 by the British Army at Farnborough and Salisbury Plain, and by the Naval School at Eastchurch. As a means of identification, these machines carried letter/number markings on their rudders. Those built at the Royal Aircraft Factory bore markings such as B.E.1, F.E.2, and S.E.1, whilst privately constructed aircraft carried such markings as B.3, F.4, and T.4. The Factory-type markings indicated the type of aircraft; B.E. was Bleriot Experimental; F.E., Farman Experimental; and S.E., Santos Dumont Experimental. These markings later formed the basis of the Factory system of type numbering.

The exact significance of the B and F serials is unknown, but the following examples have been traced: B.2, B.3 (Bréguet biplane), B.4 (Nieuport monoplane), B.6 (two-seater monoplane), F.1, F.4 (biplane), F.5 (biplane), F.7 (Bristol biplane), and F.8 (Bristol biplane). The T series appears to have been used only by the Naval School at Eastchurch, and included T.1 (biplane), T.2 (biplane), T.3 (Short triple twin), T.4 (Short triple tractor) and T.5 (Short tractor hydro-aeroplane).

In the summer of 1912, the Military Aeroplane Trials were held at Larkhill, and each of the 32 competing aircraft carried its competition entry number. This straightforward numbering system was found to be more satisfactory, and on September 1st, 1912, a similar method was adopted by the Royal Flying Corps, as the military air services had become by then. Serial numbers, to be painted on the rudder, were allotted to all military aircraft by a central authority. Under the first allocation, the Naval Wing (later known as the Royal Naval Air Service) received for its use numbers 1-200, the Military Wing numbers 201-400, and the Central Flying School at Upavon numbers 401-500. It was possible, therefore, for a prototype to have a higher serial number than a production model that went to a different branch of the Services. Production B.E.2as, for instance, included 47, 49, 50, 51 and 52, although the prototype B.E.2 was number 202.

The advent of war meant a much greater turnover of new serials, and this was at first met by allocating larger blocks to each Service. The number 10,000 was soon reached, however, this being allocated to a Blackburn-built B.E.2c, one of a batch numbered 9951-10,000 inclusive. This was the only serial ever issued containing more than four digits. Later blocks allotted for Naval use were 801-2,000, 3,001-3,999 and 8,001-10,000.

At this stage it was decided that future serials would be issued under two classifications. First, the main series—to be used on both prototypes and production aircraft of the Royal Flying Corps—was the contemporary type of serial with the addition of a prefix letter. A1-A9999 inclusive was followed by B1-B9999, then C1-C9999, etc. Secondly, there was a Naval series with N prefixed, this being further sub-divided as follows:—

N1-499: Prototype seaplanes, flying-boats, and shipboard aircraft.
N500-999: Prototype landplanes.
N1000-2999: Production seaplanes and small flying-boats.
N3000-3999: Production landplanes.
N4000-4999: Production large flying-boats.
N5000-8999: Production landplanes.
N9000-9499: Production seaplanes.
N9500-9999: Post-war production aircraft, all categories.

Not all these serials were actually used. The first block progressed only to N255 (a Parnall Peto), and the second block probably never passed N546 (the Wight Quadruplane). The series N3000-3999 seems to have been little used, the only known examples being N3004 and N3010, both Henri Farmans. Later, a series beginning the X.1 was introduced for experimental R.F.C. types. Little is known of this series, which probably never passed X25 (the Boulton and Paul P.6).

When the war ended, serials in the main series had been allocated as far as the mid-Js. Prefix letter I was not used, and letter G was used only for a special series started late in the war for captured German aircraft. This progressed to around the G150 mark. Many of the Hs and most of the Js up to J6900 were never actually used, owing to cancellation of contracts at the cessation of hostilities.

The re-birth of civil aviation, during Easter 1919, necessitated some form of identification marking, and this was first met by allocating R.A.F.-type serial numbers commencing at K.100. By the time the system was changed under international agreement to the present type of civil registration marking, serials had been allocated up to K.175. In view of this, the next series of R.A.F. numbers began, in 1927, with K1000, and no subsequent serial has ever been issued with either more or less than five symbols.

The Naval series, which was continued even after the Royal Naval Air Service and the Royal Flying Corps had combined on April 1st, 1918, to form the Royal Air Force, reached N9999 about 1925, and was succeeded by the S series, commencing at S1000. This series was abandoned in 1932 at S.1859, and all British military serials since that date have been issued in the main series.

The economies of the 1920s and early 1930s resulted in the rebuilding of many aircraft which would normally have been scrapped. These retained their original serial numbers, but a letter R was added to the prefix letter. Two examples of this were Fairey IIIFs SR1171 and SR1174 of No. 45 Squadron. Coded N2 and N1 respectively, they were originally built for Naval use. The demand for serial numbers in the post-war period was very small. The J series was not depleted until 1927, and the K series was in use for a further eight years. The rearmament drive, however, resulted in a big increase in turnover, and in the last four years of peace the L, N and P serials were exhausted. The Munich crisis also resulted in another innovation. It was realized from past experience that an enemy could keep a check on our aircraft production figures if he obtained a sufficient number of serials from aircraft shot down, and by other means. It was decided, therefore, that not all serial numbers would be used. Various systems of blocking out were at first tried. At one time, every fourth or fifth serial was omitted. Later, blocks of about a dozen serials were separated by about half a dozen unused ones. Finally, however, a system was adopted whereby production batches of aircraft were given blocks of between 40 and 50 serials, each block being separated from the previous one by between 10 and 15 unused serials. Typical of this system was a batch of Spitfire 22s serialled PK312-356, 369-412, 426-468, 481-525, 539-582 and 594-635. Different production batches were separated by blocking out a dozen or more serials, but prototypes were given odd serials in the middle of such blockings-out.

Serial Z9999 was reached soon after the outbreak of war, and it was decided to continue with a similar system which, employing two letters and three numbers, began at AA100. In order to avoid confusion, the letters C, G, I, O, Q, U and Y were not used. Exceptions were that the letter G was used as a second letter, and that the combination NC was employed. In the normal series of allocations the combinations DA, DB, EA, HA, HT, JE, JH, JJ, MR, NZ, SV, TN, TR, VE and VJ were not used.

Pre-war civil aircraft impressed for the R.A.F. seem to have been allotted serials in blocks on the same lines as production batches, blocking-out being used where necessary. The main impressment blocks were, approximately, as follows: W5740-79, W6418-64, W7940-84, W9325-89, X5051-5133, X9297-9450, Z7253-61, AV952-AW183, AX659-904, BB661-706, BB721-69, BB788-819, BB851-68, BD142-71, BK828-73, BS803-15, DG450-667, DR607-28, ES914-60, HK820-993, HM494-581 and NF747-73. Captured enemy aircraft were very often included in these blocks, as were prototypes, and early war-time purchases from America. The only exceptions to the blocking-out system were Lease-Lend aircraft and machines built in the Dominions. Reserved for these were serials ET100-HD776, JS469-KT999 and SA100-SK999. In fact, these serials were not all required, the last to be used being KP328.

The appearance of radar and other secret devices necessitated

BRITISH MILITARY SERIAL NUMBERS . . .

the guarding of aircraft carrying them. In order to distinguish these aircraft, it became the practice to add a diagonal stroke and a letter G to the serial. For example, a Lancaster B.3 used for flight refuelling experiments carried the serial NE147/G. Another innovation was to have the word SNAKE painted after the fuselage serials of aircraft which had been modified for use in tropical theatres of war. A number of Beaufighters are known to have carried this marking, one being RD758. A symbol used to indicate prototype and experimental aircraft was introduced in June 1941. This consisted of a large, yellow-ringed letter P, and was painted on each side of the fuselage, 2in aft of the roundel. All three of these systems have now fallen into disuse.

The end of the Second World War, as did the first, resulted in large cancellations of contracts, with the result that comparatively few aircraft have actually appeared with serials in the SL-VK range. Many of the German machines captured at the end of the war and brought to this country were given normal R.A.F. serials, mainly in the VH-VP range. The majority of those flown experimentally, however, were given special Air Ministry serials. These ran from A.M.1 to A.M.123, then from A.M.210 to A.M.229. In some cases, both a normal R.A.F. serial and an Air Ministry serial were allotted (e.g., Bv138B-1 VK895/A.M.52).

Mention must also be made of methods of painting the insignia and serial numbers on the aircraft. The very early machines simply carried their serials, which were quite large, on the vertical tail surfaces. The advent of war brought difficulties of identification of nationality, and a Union Jack was then painted under the wings. This was found to be unsatisfactory and the markings were changed to red, white and blue roundels on the wing tips and fuselage; and later, in addition, red, white and blue verticals on the rudder. The serial was then painted on the rear fuselage or on the vertical tail surfaces, being superimposed on the tail colours where necessary. Sometimes it was carried in both places.

Soon after the end of the 1914-18 war, serials began to be carried also on the under-surfaces of the mainplanes, facing aft under the port wing and forward under the starboard wing. The practice of carrying the serial on the tail surfaces gradually fell into disuse. In 1938, the wing serials were discarded, but revived in 1945, being painted in black on light-coloured undersurfaces, and white on dark surfaces. Naval aircraft carry the words ROYAL NAVY above the fuselage serials, which are smaller than those on R.A.F. aircraft.

In the original series of prefix letters, the letters G, I, M, O, Q, S, U and Y were not used. The letter M was employed, however, in a special series introduced, for instructional aircraft, in January 1921. They denote aircraft no longer airworthy, or are redundant, the M serial superseding the original serial, which is usually obliterated. In the majority of cases the M appears as a suffix letter (e.g., 7042M), and the series is now in the 7100M region. A similar series started later by the Royal Navy commenced at A1, and is now in the A2400 region, although there appears to have been a gap between A1000 and A2000.

In principle, no serial is allotted twice, but there are exceptions to this rule. Serials N1000-9999 were issued in 1938-39, although previously used for Naval types. A batch of R.E.8s serialled A6801-7000 was cancelled and the serials re-allocated, as were Avro 504s 8781-8830. More recently, serials TT181, 194 and 197 were allocated to the first three Vikings, but were cancelled and re-allocated when these were completed in civilian guise as G-AGOK, -L and -M.

Mistakes have also been made—as, for instance, the overlapping of the Vampire F.B.5 batch VZ301-359 with the Sea Fury T.20 batch VZ345-378; and, latterly, a batch of Sabre F.4s around the XD755-780 mark with Gyrodyne XD759 and a batch of Whirlwind HAR.2s. Examples are also known of aircraft carrying the wrong serials. Expeditors FR882 and 883 appeared as FE882 and 883, whilst Harvard FS886, coded FAC-R at Cranwell in 1947-50, was repainted in the summer of 1950 as FS586.

Current allocations are substantially on the same lines as the war-time ones. One can only conjecture as to the system to be adopted when serial ZZ999 has been reached, although at the present rate of issue this will not be until 1960. Several possibilities suggest themselves. An additional letter or number, making six in all, would appear to be quite practicable, or the series could revert to serial No. 1 again, since very few serials in the 1-Z9999 group are still flying. Letters could be used as a suffix, instead of a prefix, starting at, say, 1000A, or 100AA, or they could even be used centrally (e.g., 29A73).

1955 tailpiece: a Valiant serial.

HELICOPTERS FOR THE ANTARCTIC

FURTHER details are now available of the flying equipment being used on Hunting Aerosurvey's expedition to Grahamland, reference to which was made in *Flight* of September 30th. The expedition's vessel *Oluf Sven* was preparing to leave London last week-end. She carries two Sikorsky S-51s, which will operate from a flight deck constructed over the two midship cargo hatches. The foremast has been removed to allow the helicopters a clear path to climb away over the bow. The flight deck, which has a guard and safety net along each side, measures 80ft by 30ft. Because of the comparatively narrow beam—with the helicopter's rotor diameter of nearly 50ft the blades will project outboard—take-offs and landings will call for considerable skill from the two pilots, Capts. Greville Jacques and Stanley Holdaway. A portable canvas hangar has been provided on the after end of the flight deck, together with a workshop which will provide servicing facilities.

Trial landings by one of the helicopters, which flew from Autair's base at Croydon, were made last week. According to Mr. W. H. Armstrong, managing director of the company, this is the first time that a British helicopter operator has taken part in an Antarctic expedition, and planning for the operation has involved the design of many special items of equipment. Among these is the skid-landing gear—illustrated on this page—designed to prevent the aircraft sticking to ice or snow after touch-down. One of the principal duties of the helicopters will be to ferry the survey parties between ship and shore and to transport aerial photography equipment. While they are in the air their comprehensive radio installations will be used as a communication link between the *Oluf Sven*, the ground parties and the fixed-wing aircraft—Canso Amphibians—engaged on the survey work.

Installation of the radio equipment in the *Oluf Sven* has been entrusted to International Aeradio, Ltd., and in the Antarctic three of their technicians will be responsible for the maintenance and certain operational aspects of all communications and navigational aid equipment in the aircraft, the base headquarters and with the surveying parties. The equipment consists of H.F. and V.H.F. radio, radio compasses, Rebecca-Eureka system for bad visibility approaches and landings, and a radio beacon providing homing facilities at the base camp. The three technicians are M. R. Milburn, M.B.E., Frederick H. Shaw, and John Corlett.

One of the "Antarctic" undercarriages fitted to the S-51s. It is intended to prevent the wheels sinking into snow or freezing to ice or snow—always a serious problem in polar flying.

Design starts from an attitude of mind

The real starting point of aircraft design at ENGLISH ELECTRIC is not a piece of drawing paper but an attitude of mind.

There was a time when admirable aeroplanes were designed by drawing (and re-drawing) until their nicely flowing curves were good to look at. This simple philosophy lasted surprisingly long, but it had unhappy side-effects. It inspired some unthinking people to believe that the intuition of an artist was a satisfactory substitute for the enquiring mind of the scientist. What worked—generally, but not always—in the low-subsonic piston age doesn't work today. Today there is *no* substitute for knowledge. Today the tools of the design team are the same as the tools of the scientist—analogue computors, supersonic wind-tunnels, electronic laboratory gear, harmonic analysers, cathode ray oscilloscopes and the kitchen stove and refrigerator (in larger and more highly-developed forms). But even then what finally matters is the team's attitude of mind towards its tools.

Our attitude at ENGLISH ELECTRIC is one of open-minded enquiry into what is a dauntingly big and complex problem. There are no tools we will not use—even if we have to invent them first—to find out all we have to find out; and there is no substitute for finding out. Before ever a new aeroplane flies, it must have been 'flown' on the ground until nothing that is knowable without test flying is left unknown.

This is a long and costly business—but today it is less long and far less costly than relying on a hunch and a hope.

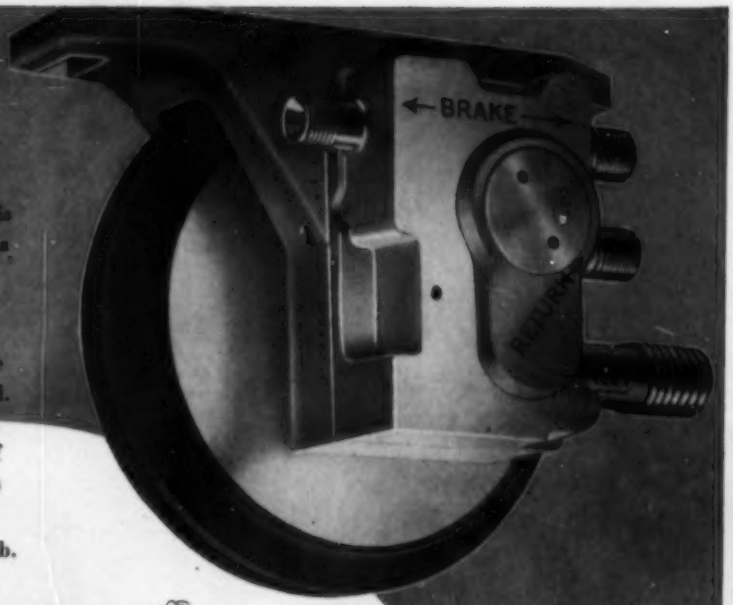
'ENGLISH ELECTRIC' aircraft

THE ENGLISH ELECTRIC COMPANY LIMITED · QUEENS HOUSE · KINGSWAY · LONDON · WC2

Brake control systems incorporating the 'MAXARET' Anti-skid Unit represent the greatest advance in aircraft braking since the introduction of the Dunlop plate brake. The diagram illustrated opposite shows a typical brake system using these components.

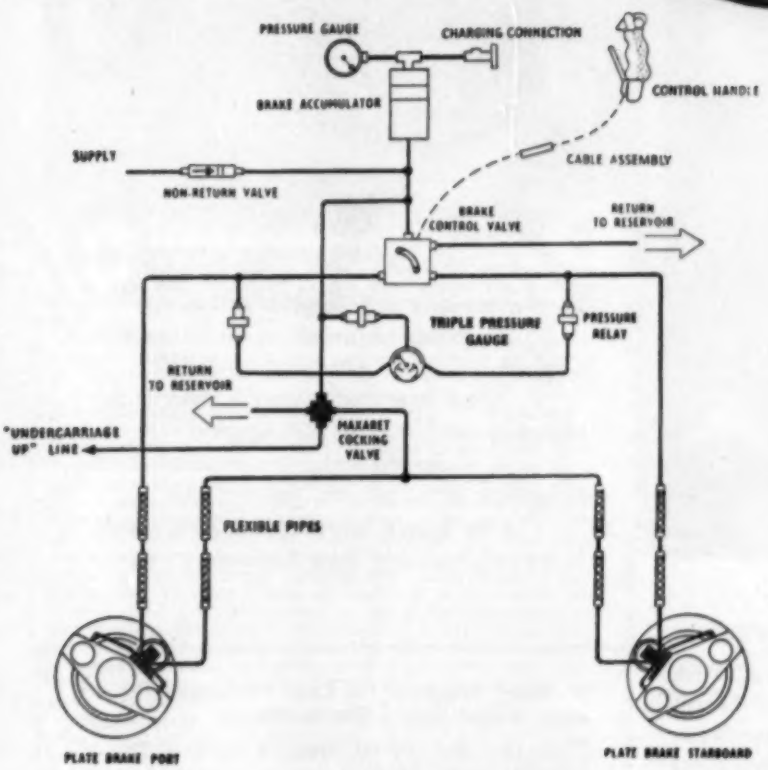
DUNLOP

'MAXARET' BRAKE CONTROL SYSTEM means safer, more economical operation



In the 'Maxaret' the control valve is regulated by a fly-wheel housed in a rubber-tyred shell which is rotated by contact with the landing wheel. Excessive deceleration releases pressure in the brake and closes the supply until wheel speed is regained. Provision is made for holding off brakes in a 'bounce landing'. Chief advantages are shorter landing runs and prolonged tyre life.

SIZE 4½" x 3⅞" x 2¼" *WEIGHT* 4·7 lb.



This valve prevents the brake being applied before the wheels are freely rotating after touch-down. When 'Undercarriage Up' is selected the brakes are applied until retraction is complete. On releasing pressure the 'Maxaret' Units are locked ready for landing.

Man-carrying Ramjets

(Photo by courtesy of "The Aeroplane")

The current issue of "Wiggin Nickel Alloys" contains an article on the history and development of the Leduc ramjets, aircraft which have made France a leader in the piloted ramjet field. The photograph shows the Leduc 021 mounted on its Languedoc carrier aircraft. Inconel*, one of the Wiggin heat-resisting alloys, is used in the power plant of these machines.

Other features in this issue include :

A Frangible Crash Switch
Heat Insulating Blankets for Turbine Aircraft
Nimonic* Alloys for Turbine Rotor Blades
Proving the Proteus
Service Experience with Dart Engines
Nimoply* 75 in an Aircraft Combustion Heater

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Pronouncements on Farnborough—and Biggin Hill

I SHOULD like to assure Mr. P. Russell (Correspondence, October 7th) that he is not the only one with a complaint about the Farnborough Air Show arrangements, although mine is of a different nature—food.

I too went on the expensive Friday and arrived during the morning. When I thought lunch was indicated I set out in search of a refreshment tent. Alas for my optimism! My first discovery was reserved for exhibitors, the next for the Press; after a good deal of walking I espied a tent marked "Refreshments" but found it closed; the same applied to the next one. Assuming (perhaps wrongly) that the one marked "Bar" served only liquid refreshment I passed my fifth tent by. My life was at last saved by a hot-dog stall. May I suggest that places of refreshment should be marked on the programme map?

Plymouth, Devon. JOYCE QUICK.

MAY I endorse Mr. E. G. Lawrence's letter of October 7th? I think the R.A.F. are taking security measures to the extreme. I had a film taken from me at R.A.F. Station Biggin Hill after trying to get a shot of the "Brisfit" in flight. I handed the film over to an S.P. "host" on the understanding that the film would be sent on to me after, as I had a few shots of the German aircraft on Horse Guards Parade. As I have had no communication of any sort about this matter I have written them off with the conclusion that the R.A.F. still considers the Ju 88 as "top secret." I might add that cameras were in use everywhere and the only notice I found forbidding the use of same was on departing at the main gate.

London, E.17. B. T. GIBBINS.

The Accident to G-AMOK

NOW that ample time has been allowed for any views from the various interested parties to be expressed I feel that independent comment is due on the findings of the official Inquiry into the Viscount accident at London Airport last January.

In the first case, the Inquiry has found the captain and co-pilot of Viscount G-AMOK alone to blame for this accident. At no time does the report suggest that Control was anything but thoroughly efficient, and even states that there was no fault to be found in this aspect.

Now, in this unfortunate affair I feel that I can write with a certain amount of professional knowledge, having qualified in all aspects of air traffic control. And, under the circumstances, I cannot see how the control set-up can avoid censure. G-AMOK accepts a recognized and qualified Control in conditions of bad visibility. Thereby, the captain has delegated, and Control accepted, a portion of his responsibility. Under these circumstances he has every right to assume that before he is issued take-off clearance he will be, in fact, clear to take off.

It is clear from the report of the Inquiry that the aircraft unknowingly turned on to a disused runway, although the comparatively short taxying run should have warned both pilots that something was not as it should have been. Further, it is also made clear that proper markings to I.C.A.O. standards were not in use. In other words, although the captain made this initial mistake (itself, at the time, of very minor importance) the very markings that ought to have brought this home to him were to all intents and purposes non-existent. As a result, G-AMOK lines up on a disused, and obstructed runway, and requests take-off clearance from those who have accepted responsibility for giving such clearance.

Now, one of the fundamentals of aerodrome control is a complete liaison between the aerodrome controller and the runway controller, who, as we all know, has his being in a caravan at the end of the runway used for take-off and landing. So, when G-AMOK lined up, there was, or should have been, a qualified controller within a matter of a few yards of the aircraft, had it been lined up on the correct runway. This runway controller would have been able to hear the Viscount's engines during the wait for take-off clearance.

Now, surely it is still current practice at least to inform the runway controller that an aircraft is taxying out to take off, especially under such weather conditions. In fact, it is—or was—normal for the tower to check with the R.W.C. before issuing take-off clearance, and most runway caravans are provided with facilities for listening to R/T instructions in any case. If no such liaison exists, and the London Airport R.W.C. is virtually isolated, then something was fundamentally wrong in the general basic set-up.

Had the normal system been in operation up to the time of the accident a runway controller would have immediately informed Control on hearing G-AMOK call for take-off clearance, or on receiving information from Control concerning G-AMOK wishing to take-off, that the aircraft was not at take-off position. I consider that the captain was entitled to assume that under the circumstances he was correctly positioned and that he was entirely correct, upon receiving take-off clearance, in commencing his take-off.

So, let us, for a change, stop this eternal, almost automatic blaming of the pilot. Air Traffic Control is a public service in the U.K. If it fails, as it would appear to have done in the case of the Viscount accident, then it must accept its share of the blame fairly and squarely.

Alton, Hants. U. H. H. GROVER.

[In the report of the Inquiry (summarized in *Flight* of September 23rd) the duties of the runway controller are described as being: "to log the time of aircraft taking off and landing, to see that runways in use are kept clear, and that there is nothing amiss with aircraft passing him to take off or about to land. When visibility is bad the duties of the runway controller are increased and also become of much greater importance, since, in addition to his duties in clear weather which remain, he has the additional task of calculating the runway visual range."

The report states that the runway controller on duty at the time was in no way to blame for what occurred, and that "his inaction in not reporting the absence of Oboe-King at the true take-off position for Runway 15R was not a matter for which he can be held responsible . . . his duties in conditions of bad visibility were more than anyone, however competent and careful, could reasonably hope to discharge to the full."

The report does not state that it is the duty of the air controller to check with the runway controller before issuing take-off clearance, but recommends that in bad visibility clearance for take-off should not be given until the control tower has received a report from the appropriate runway controller that the aircraft is in the proper take-off position.—Ed.]

Nothing Special

WE find that there is a fairly widespread belief that the Aiglet flown by Mr. Ranald Porteous at Farnborough and other flying displays is a special machine strengthened or "souped up" for his aerobatic routine.

This may tend to negative the whole point of these demonstrations and, if through your kindness we may, we would like to assure any who may be interested that the machine is a completely standard J/5L three-seater Aiglet in no way different from any other coming off the line.

In fact it carries quite a lot of extra optional equipment such as starter, battery, generator, full blind flying panel, extra fuel tank, etc., and receives no unusual maintenance or special grooming.

Leicester. G. H. WORRALL,
Publicity Manager, Auster Aircraft, Ltd.

FORTHCOMING EVENTS

Oct. 21. Surrey Flying Club: Annual Dinner and Dance.
Oct. 25. R.Ae.S.: Section Lecture: "Boundary Layer Effects in Supersonic Flow," by R. J. Monaghan.
Oct. 26. British Institution of Radio Engineers: Annual General Meeting and Lecture.
Oct. 27-28. Aircraft Electrical Society: 12th Annual Display of Aircraft Electrical Equipment, Los Angeles.
Oct. 28. R.Ae.S.: Graduates and Students Section: Dance.
Oct. 28. Aerauto Association (Chelsea College Old Students): Dinner and Dance, Ardington Rooms, London, S.W.4.
Nov. 2. Institute of Welding: Annual Dinner, Park Lane Hotel.
Nov. 2-3. Institute of Welding: Autumn Meeting.
Nov. 3-4. I.A.S. and C.A.I.: Second Annual Joint Meeting, Ottawa.
Nov. 9. Institute of Transport: Anniversary Luncheon.
Nov. 11. Helicopter Association: "Design of Helicopter Operating Sites," by H. T. Hough, M.I.C.E., M.I.Mun.E., M.T.P.I.
Nov. 18. Elstree Flying Club: Informal Reunion of Pre-war Brooklands Flying Club Members.
Dec. 2. Aircraft Golfing Society: Dinner and Dance.
Dec. 16. London Airport Inauguration by H.M. the Queen.

R.Ae.S. Branch Fixtures (to November 24th):—

Oct. 27, *Bristol*, Film Show. Oct. 31, *Halton*, "Problems of Space Flight," by F/L. R. W. Durrant. Nov. 1, *Belfast*, "Medical Aspects of High Performance Flight," by W/C. F. Latham; *Boscombe Down*, "Aircraft Engineering and Operations in the Arctic," by Maj. J. H. Webb, U.S.A.F. Nov. 2, *Southampton*, "Flight Refuelling," by P. S. McGregor. Nov. 3, *Isle of Wight*, Annual Dinner. Nov. 14, *Bristol*, *Junior Members'* Papers Competition. Nov. 16, *Manchester*, "Interplanetary Flight," by E. Burgess. Nov. 24, *Isle of Wight*, "Ejection from High Speed Aircraft," by J. Martin.

THE INDUSTRY

Garringtons' New Laboratory

ON Tuesday last week Garringtons, Ltd., celebrated the opening of the new laboratory at their Bromsgrove factory with a considerable reception. The new two-storey building, with its 6,000 sq ft floor area, was formally opened with a large golden key by Dr. T. Emmerson of the G. K. N. Group Research Laboratory, which organization had advised in the preparation of the new building.

Full facilities are provided for mechanical testing and chemistry, metallography, photography, pyrometry and experimental heat-treatment. In addition there are administrative offices and archives, a photographic laboratory, and a lift for transferring samples from floor to floor. Here the work of the previous laboratory—which was underground—will be carried on in considerably more congenial surroundings.

The opening ceremony, and a tour of the new building, were followed by a luncheon to which a large number of guests from the G.K.N. Group and from the Ministries, and customers and even competitors, had been invited. It was stressed in the after-lunch speeches that the opening had been taken as an opportunity for gathering together technical personnel and for drawing the "back room" men out from their back rooms. In this the function was entirely successful. After the luncheon, a film made by the company, tracing the development of the group from early days, was shown. Guests were then taken on a tour of the large forging works and the new turbine-blade factory before returning to their various back rooms.

Teddington-Giannini Agreement

YET another agreement has been announced between a British and an American manufacturer whereby the British company will manufacture the transatlantically designed equipment. In this case the British firm is Teddington Aircraft Controls, Ltd., and the American company G. M. Giannini and Company, Inc., of Pasadena, Cal., and New York.

Giannini have established a British affiliate, known as Giannini, Ltd., who will look after Giannini interests in the British Commonwealth except Canada and liaise with any European licensees, such as Teddington. The directors of Giannini, Ltd., are Messrs Christopher Dykes and Bernard Sutton, who may be reached at 31, Pembroke Gardens, London, W.8 (Western 9493). The main factory of Teddington Aircraft Controls is at Cefn Coed, Merthyr Tydfil, S. Wales, and their London office is at 51, Brompton Road, London, S.W.3 (Kensington 4808).

Both firms are large producers of control, instrumentation, measuring and other forms of precision equipment for aircraft and missiles. The new agreement permits Teddington to manufacture and market a range of Giannini potentiometers, accelerometers and transducers, and also to develop this equipment for the British industry. A noteworthy point is that Giannini, Ltd., are permitted by the Bank of England to conduct all negotiations in Sterling—possibly creating a precedent.

Three Giannini products which will be developed, manufactured and marketed by Teddington Aircraft Controls, Ltd., under the terms of the agreement announced here.

Three Giannini units are shown in the photograph. At the left is the 47154 pressure transducer, the smallest capsule-type unit of all with a weight of 4½ oz including a steel fitting. Output can be as high as 50 V D.C., and linearity is ±1.5 per cent and resolution up to 0.4 per cent from 0 to 5 or 0 to 30 lb/sq in. In the centre is the 46118, a small bourdon-type pressure transducer, capable of use up to 6,500 lb/sq in and fitted for conditions of high vibration or with corrosive liquids or gases. On the right is the 24117 linear accelerometer, an oil-damped unit with a natural-frequency range from 31 to 89 c.p.s. Resolution is ±0.5 per cent and linearity better than 1 per cent.

Sir George H. Nelson (right) examines the book containing English Electric employees' signatures (see "Tokens of Esteem," below). On the left is Mr. P. Horsfall, the director who made the presentation.

Tokens of Esteem

TWENTY-FIVE years' leadership of the English Electric organization by Sir George H. Nelson (chairman and managing director) has been marked by the company's employees.

At a recent ceremony at Trentham Gardens, Staffs, a gift of Georgian silver and a hand-made leather-bound book, containing the signatures of many thousands of employees who had subscribed to a presentation fund, was handed to Sir George by Mr. Percy Horsfall, a director of the company. A visitors' book, hand-made, was also presented to Lady Nelson.

Present at the ceremony were some 2,500 employees and their wives; nearly all of them had served English Electric for twenty-five years or more.

Before he was 18, Sir George Nelson had gained a Mitchell exhibition, a Brush studentship, and a diploma in electrical engineering in the City and Guilds College, with which he has been closely connected ever since. He became managing director of English Electric in 1930, and chairman in 1933; he was knighted in 1943 and created a baronet this year.

IN BRIEF

We regret to learn of the death, on September 30th, of Mr. Eric Vernon, senior aircraft servicing representative of Docker Brothers. He died after a sudden and brief illness.

* * *

At a recent Board meeting, Mr. K. Mills, secretary of Dowty Equipment, Ltd., was appointed company secretary of Dowty Fuel Systems, Ltd.

* * *

Two hundred chairs upholstered in Dunlopillo have been ordered for the airport at Singapore.

* * *

The directors of the British Aviation Insurance Co., Ltd., announce that Mr. Alan B. Hunter, A.F.R.Ae.S., has been appointed principal surveyor of the company with effect from October 1st, 1955.

* * *

An extremely comprehensive catalogue has been issued by Ransome and Marles, Ltd. Giving information on almost the entire range of ball and roller bearings the company manufacture, the publication is well arranged for quick reference.

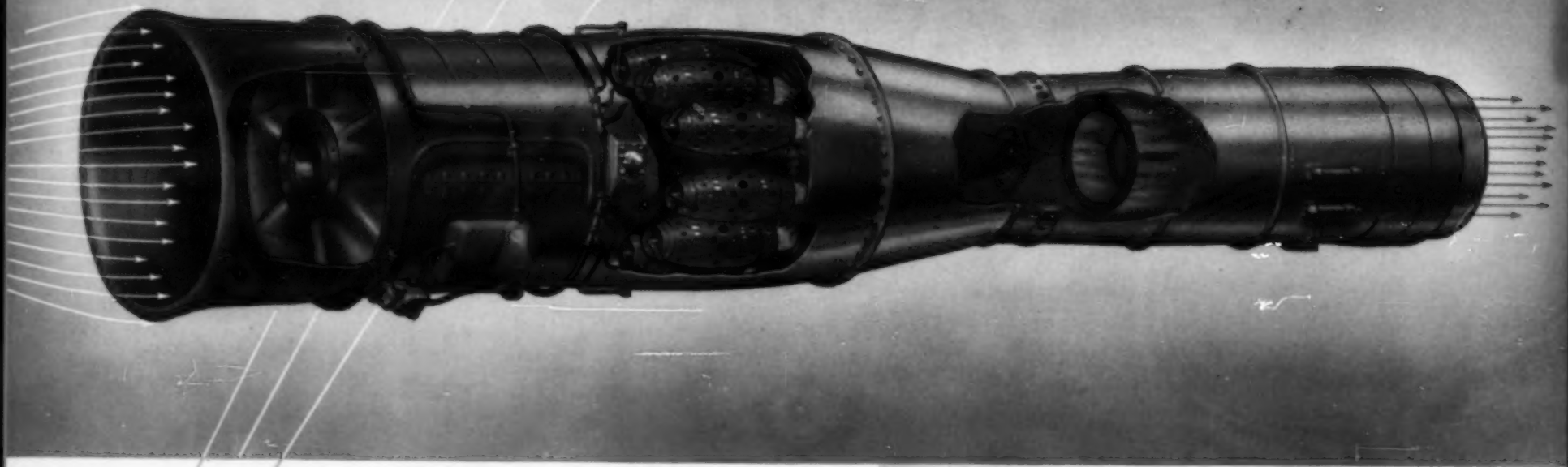
* * *

B. O. Morris, Ltd., of Coventry, have concluded an agreement with Hammond Machinery Builders, Ltd., of Kalamazoo, Michigan, to manufacture under licence in this country the latter company's automatic and semi-automatic polishing equipment, including rotary and straight-line machines. Production of the range of machines has already begun.

* * *

Mr. John H. Lord, Dunlop executive director, left London recently by air on a visit to India, Malaya and Japan. He is visiting the company's factories and plantations and having discussions with government and other officials. From Japan he will fly back *via* Los Angeles and the polar route to Copenhagen, and thence to London at the end of this month.

Specialists in Gas Turbine Combustion Components



BRIGGS MOTOR BODIES LIMITED

SWAYTHLING, SOUTHAMPTON

HEAD OFFICE: DAGENHAM, ESSEX

The illustration shows a typical Aircraft Gas Turb ne Engine. The parts shown in red and grey, comprising:

Fleme Tubes, Combustion Chamber Outer Casing, Exhaust Unit, Reheat Jet Pipe Assembly

are manufactured at our Works at Southampton.

We also manufacture the following major units:

- **Front Nozzle Box Panels.**
- **Discharge Nozzles.**
- **Cooling Air Manifolds.**
- **Annular Combustion Chambers (complete)**
- **Combustion Chamber Heat Shrouds**
- **Stator Conical Supports**
- **Outlet Branch Extension Units**
- **Bearing Housing Units**
- **Bearing Cover Units**
- **Fire Wall Units**
- **Oil Tank Units**
- **Jet Pipe Assemblies**

AS IT WAS . . .

THE HAWKER FURY MK. II, the ultimate in Biplane cleanliness and the first R.A.F. fighter to exceed 250 m.p.h. Its successor was the 350 m.p.h. Hurricane of undying memory, which was followed by other famous Hawker piston-engined fighters, notably the Typhoon and Tempest. The latest in the long line of pedigree Hawker fighter aircraft is the supersonic Avon-powered Hunter, now in large-scale production for the Royal Air Force and the air forces of several other nations.

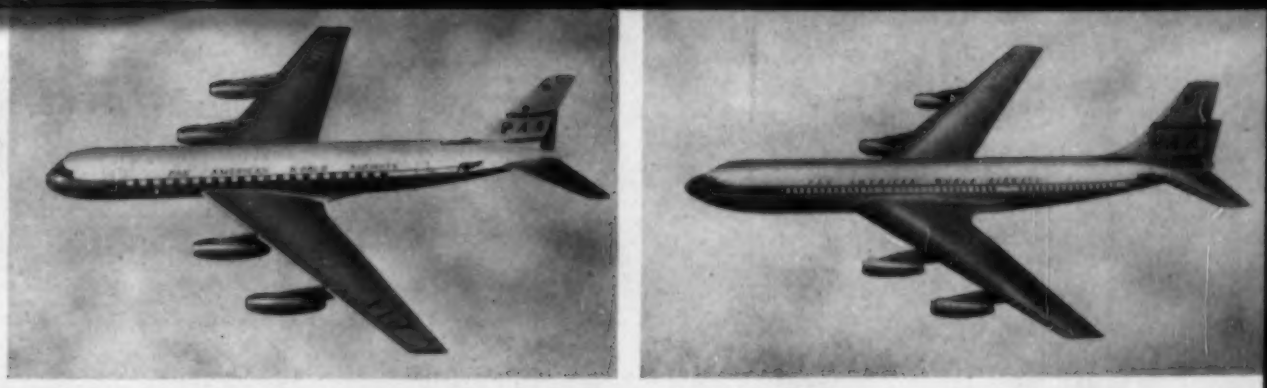
Still the pace quickens, and every new project brings fresh problems. Questions about fuels and lubricants to meet these increasingly exacting conditions are the constant concern of ESSO research groups whose information and advice are freely at the disposal of enquirers with problems in this field.

It pays to consult

ESSO

ON ALL FUEL AND LUBRICATING PROBLEMS

ESSO PETROLEUM COMPANY LIMITED, 36 QUEEN ANNE'S GATE, LONDON, S.W.1. *AVIATION TECHNICAL SERVICE, RELIANCE 1261*



The striking similarity between the Douglas DC-8 (left) and the Boeing 707 is apparent in these impressions of the two PanAm Jet Clippers.

CIVIL AVIATION

THE PAN AMERICAN JET ORDER

PROBABLY the most significant order in the history of air transport to date was that announced by Pan American World Airways on October 13th. The order—more accurately, orders, since two manufacturers are involved—for 45 American-built jet transports, 20 Boeing 707 Stratoliners and 25 Douglas DC-8s, is the most expensive (£96 million) ever placed by an airline. Its effect on the future development of both sea and air travel over long distances is certain to be far-reaching; already it seems uncertain that some of the smaller airlines will be able to stand the competitive pace set by re-equipment on such a scale. The PanAm jet fleet alone, when operating at full strength, is theoretically capable of hauling annually three times the *total* transatlantic passenger traffic carried by all airlines during 1954.

The text of the PanAm announcement was as follows:—

"Forty-five American-built jet transports—able to fly non-stop at 575 m.p.h. between New York and London in 6 hr 15 min—have been purchased by Pan American Airways at a cost of £96,000,000, the largest order ever executed by a commercial airline. The airplanes are the Boeing 707 and the DC-8 and the order, announced yesterday by Juan T. Trippe, Pan American World Airways president, is the first to be placed by any airline for U.S.-built jet transports.

"Twenty Boeings, carrying 104 passengers in the standard configuration, and 125 tourist, will be delivered to Pan American starting December 1958. Twenty-five Douglas aircraft carrying 108 passengers in the standard seating and 131 tourist will be delivered a year later, in December 1959.

"The airline has also signed a contract with United Aircraft Corporation for Pratt and Whitney engines to power both planes. . . . This huge financial commitment for new flight equipment 'is complete evidence of Pan American's faith and confidence in the continued expansion of sound two-way international trade,' said Mr. Trippe, as well as greatly increased tourist travel between the United States and the 74 foreign nations regularly served by Pan American Clippers."

Few specific details of either the Boeing or the Douglas jet transports has so far been made available, and we have accordingly prepared the following descriptions, which include all that can be published at the present time. These notes, while emphasizing the similarity of the two types, also reveal certain differences.

Boeing 707.—A low-mid-wing machine, with 35 deg sweep, powered by four Pratt and Whitney J57 turbojets. The design is a direct development of the original 707 prototype, which first flew on July 15th, 1954. On August 5th last year the U.S.A.F. stated that it would buy a number of tanker versions of this aircraft, and a large contract (believed to be for 250 KC-135s) was signed the following month. The U.S.A.F. has now allowed Boeing to develop and produce a civil airliner in parallel with the tanker, and this is the machine which PanAm have bought.

The civil 707 has a span of 130ft 10in and a fuselage of 134ft 6in length; it is, therefore, a larger machine than the prototype, and the weight has gone up to over 230,000 lb. The power units will be four "advanced models" of the Pratt and Whitney JT3 turbojet (the civil J57), rated at over 10,000 lb thrust apiece (probably 11,000 lb). These will provide a cruising speed of "above 550 m.p.h." between 25,000 and 40,000ft. Seating can be provided for between 80 and 130 passengers, according to the route.

Structural details are similar to those made familiar by the 707 prototype. The JT3s will be in single pods and the landing gear will comprise four-wheel bogie main units and a twin-wheel nose unit. Baggage and power services will be housed in the pressurized "lower bubble" of the fuselage. Owing to the high wing sweep, lateral control will be provided by spoilers.

DC-8.—In general layout, this can be described as a very slightly larger, rather more efficient transport than the 707, having an identical layout with the exception of the following details: slightly less wing sweep, permitting the achievement of a better lift coefficient and the use of conventional ailerons; a curious type of main undercarriage, with four main wheels on a single axle on each main leg; and completely new powerplants. The latter will be Pratt and Whitney JT4s, civil versions of the new J75 turbojet. The latter engine, which has now been flying in a B-45 test-bed for five months, is initially rated at 15,000 lb thrust, and is a larger and heavier unit than the JT3. On the other hand, it will certainly be needed for the overwater version of the DC-8, which is at present seen as a 257,000 lb machine.

PanAm have said that the DC-8 will be rather more efficient than the Boeing, and it is expected to cruise at about Mach 0.88 (it is believed Douglas are quoting a guaranteed cruise of 575 m.p.h.). Range of the Douglas will also be higher than that of the Boeing 707, i.e., it will be greater than 5,000 miles in still air. It is certain that the DC-8 will be an all-the-year-round transatlantic machine (to London or Paris), although Ivar L. Shogran, DC-8 chief project engineer, has stressed the economy of the type on shorter routes.

Both the DC-8 and the 707 will have special types of silencing equipment and reverse-thrust mechanisms. Juan L. Trippe is quoted as saying, "the new transports will make little more noise on the ground than present piston-engined planes."

The exact cost of the PanAm order is reported to be £96,071,429, of which Douglas will receive £57,142,857 and Boeing the remainder. On the basis of these figures the approximate costs of the DC-8 and the Stratoliner are respectively £2,285,000 and £1,945,000 each. In 1953 P.A.A. became the first airline to place a firm order for the Comet 3, and though production of this type is not now intended the airline was regarded as a likely customer for the Comet 4. This possibility cannot be ruled out in the light of last week's announcement, since the Boeing and Douglas jet transports are designed for longer stages and higher densities than the Comet 4 and are thus not strictly competitive.

Moreover, PanAm have themselves reaffirmed their "continuing interest in the de Havilland jet programme" adding that "certain confidential written understandings exist between the two companies, looking towards a successful outcome." In addition to their long distance, high-density, mainline routes for which the Boeing and Douglas jet transports are primarily intended, PanAm also carry a great deal of shorter-stage sector traffic in their DC-6Bs and the Comet 4 might be considered as a suitable replacement for these aircraft.

The placing of this first firm order for American-built jet transports has been preceded for some months by a "war of nerves" among several United States carriers. Eastern, National and United airlines have been quoted as planning the purchase of a total of 51 Douglas or Boeing jet airliners. There is no doubt that by ordering *both* types in substantial numbers PanAm have taken by surprise a large section of the airline industry. The disadvantages of operating two aircraft types for essentially similar duties are obvious; but presumably these are in PanAm's view offset by the lead thus established over all competitors.

The majority of PanAm's world-wide services are operated by a fleet of 26 Stratocruisers and 45 DC-6Bs, now being succeeded by the larger, faster DC-7 series. Early this year the airline signed a £43m contract with Douglas for 40 aircraft of this type, of which 33 will be DC-7C Seven Seas, the others DC-7Bs.

Last year PanAm's share of transatlantic traffic was almost 30 per cent and this proportion, already increased during 1955 by the introduction of DC-7Bs, is certain to be further enlarged when the Seven Seas come on to the route next year. Unless unforeseen snags delay the jet programme there can be little doubt that PanAm will dominate this key route by the end of the present decade.

Development of engines giving the requisite power is not the only problem to be overcome before the new Boeing and Douglas transports enter airline service. A reminder of the ever-present noise problem came from the chairman of the Port of New York Authority, who last week warned PanAm that jets would not be allowed in the New York area at their present noise-level. Permission to land at Idlewild was denied to Boeing on Sunday, when the 707 flew non-stop from Seattle to Andrews A.F.B., Washington, in 3 hr 58 min. This flight, completed at an average speed of 592 m.p.h. (allegedly without tailwind assistance) set up an unofficial transcontinental record.

CIVIL AVIATION . . .

NEW HERON ORDERS

TWO repeat orders for Series 2 Herons have been announced by de Havilland. One is from the Shell Petroleum Company who have bought a second "special executive version"; the other, from West African Airways Corporation, is for three 14-seat airline versions. This latter order will bring the number of Herons ordered by W.A.A.C. to eight, of which four are already in service with a fifth due for delivery shortly.

LUFTHANSA TRANSATLANTIC

COMPLETION of the airline's 200th crossing of the North Atlantic was announced by Lufthansa on October 14th. The use of tip-tanked L.1049G Super Constellations on this service, which was inaugurated in June, has enabled Lufthansa to operate all eastbound crossings from New York to Shannon, Dusseldorf or Frankfurt without a refuelling stop.

Lufthansa's North Atlantic services, which account for about two-thirds of the company's revenue, have been running at a load factor of some 45 per cent. On the European services, the load factor has been about 60 per cent.

AIRPORT ENTERPRISE

BY and large, the airports of the world are run at a loss, to the extent that income from landing fees, rents, concessions and the like do not offset capital costs and running expenses. It is not possible, of course, to assess in terms of hard cash the military or social value of an airport, or even the benefits of the trade which it attracts. It need not be assumed that this situation will never change; with each passing year, the majority of airports earn more revenue from traffic, and the burden of capital costs tends to decrease.

Meanwhile, are airports doing everything possible to cut their deficits? An I.C.A.O. document of a few years back concluded that some were relying too heavily on their supporting communities and their users to carry them through the lean years. It is probable that, in many cases, this view holds good today. One wonders, for example, whether European airports have explored all the possibilities of increasing concession revenues, or of stimulating traffic.

The Port of New York Authority, which controls the terminal facilities for one of the world's busiest air-traffic centres, recently set an example of enterprise in airport management which might well have applications elsewhere. This takes the form of a remarkably comprehensive "service to shippers," applying equally to all potential users of air freight, large and small. The Authority undertake to provide information, without charge, on types of aircraft, schedules, customs procedures, freight forwarding and warehousing facilities, financing and insurance and several other aspects of air-freighting procedures. The P.N.Y.A. also offer an advisory service, through the U.S. and N.Y. State Departments of Commerce, "to foreign buyers looking for products, markets and outlets."

In launching this service, the P.N.Y.A. have shown a far-sighted approach, for though it is of direct value mainly to shippers and operators, the long-term benefits to the airport management, in terms of increased turnover, should be considerable. Further details of the plan may be had from the Aviation Development Division of the P.N.Y.A. Aviation Department at 111, Eighth Avenue at 15th Street, New York 11, N.Y.

WATERLOO-L.A.P. HELICOPTERS

INITIAL results of the helicopter service between the South Bank site and London Airport, which began on July 25th this year, are reported by B.E.A. By the first week of October the two Whirlwinds had operated 1,000 flights with a regularity of 97 per cent. Passengers carried totalled 2,000 and loads of newspapers and freight brought the achieved load factor to 71 per cent. Subject to V.F.R. conditions, this 15-minute service will continue throughout the winter at a frequency of four return flights daily on week-days.

FRENCH RESTRICTION

IT was announced by the French Transport Ministry on October 7th that over the next five years only one privately owned French airline would be allowed to compete with Air France on any one air route in the French union. The Ministry said that Air France would also continue to receive preferential treatment on international routes, except in South Africa, south-east Asia and Oceania.

According to an agency report, the Ministry statement added that: "Until now Air France, governed by a legal statute, and the big private companies which were still under a system of precarious permits subject to cancellations, joined in disorganized competition which was ruinous for them all."

BREVITIES

THE Aer Lingus Viscount fleet, which went into operation in April 1954, has just completed its first 10,000 flying hours. Over this period the four aircraft have carried more than 250,000 passengers and made 7,000 take-offs and landings.

* * *

The president of K.L.M., General Alger, visited the United States last month for jet-transport discussions with Douglas and Boeing. Members of K.L.M. are among airline executives who have piloted or flown in the Boeing 707 prototype during recent weeks.

* * *

Iraq has officially stated that the use of Iraqi airports will be denied to any commercial aircraft passing through Israel on the same journey. The statement, which followed the landing at Baghdad of an Air France aircraft which had previously called at Israel, was described as "a final warning."

* * *

Mr. Vernon D. Crudge, who was manager of B.O.A.C.'s Atlantic division from 1946-1948 and of the Corporation's western division from 1948-1950, has been retained by the Boeing Airplane Co. as a special consultant. Mr. Crudge, who joined Imperial Airways in 1931, has been an aviation consultant in New York since 1950.

* * *

One of the tasks faced by the delegates to the 1955 I.A.T.A. traffic conference, results of which were reported in *Flight* last week, was the scrutiny and approval of charts showing minimum seating densities for all the major types of aircraft used by member airlines on tourist services. Altogether 29 types were involved ranging from DC-3s to Britannia 300s. It was announced at the conference that despite a twelve-month study by traffic and engineering experts, it had proved impossible to evolve an acceptable "standard formula" for tourist seating accommodation.

* * *

Charter work, surveys, crop-spraying and forest control are some of the duties envisaged for A.N.A.'s Bristol Sycamore, which will be delivered before the end of this year. Capt. Max Holyman, who is to be chief test pilot of the airline's helicopter division, recently began a 40 hr conversion course on the Sycamore at Filton; earlier, he had completed basic training with Fison-Airwork at Cambridge.

It is reported from Johannesburg that South African Airways are considering the operation of an Indian Ocean service to Sydney when their three DC-7Bs are delivered early next year. The opening of a service to Israel is also under consideration.

* * *

Ten DC-7Cs ordered by B.O.A.C. will be equipped with R.C.A. storm warning radar, as already adopted by Swissair and a number of American airlines. For their Britannias, B.O.A.C. have already specified British Ekco radar.

* * *

After ten years as Airwork's publicity manager, Miss Ann Finnie (in private life, Mrs. Edward Moore) is retiring to devote more time to her family. Miss Finnie is succeeded by Miss Elisabeth de Stroumillo.

* * *

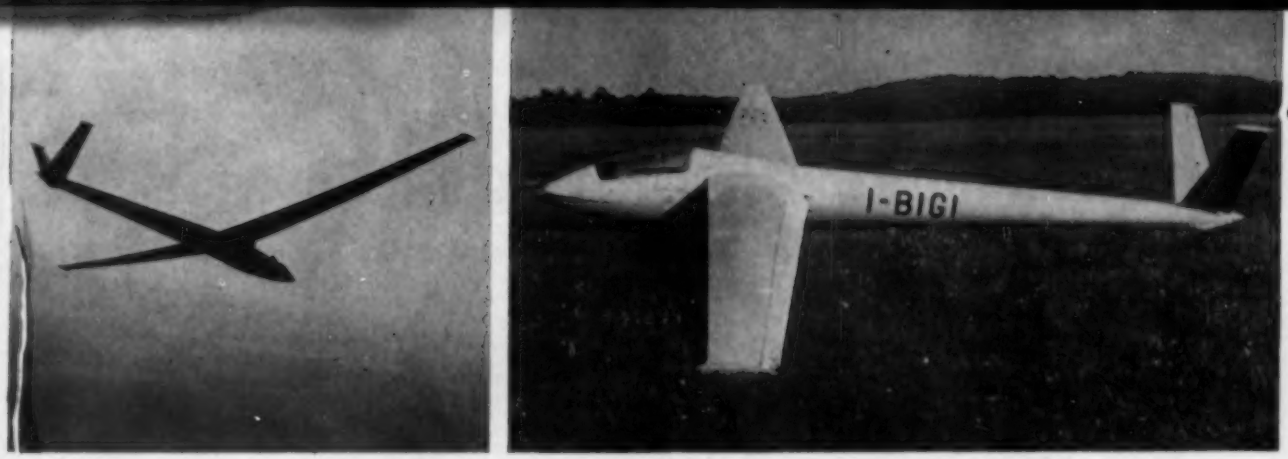
The Armagnac of S.A.G.E.T.A. which landed at Vnukovo on September 14th was perhaps the largest civil aircraft to have visited Moscow. During the visit, it is reported, the opportunity was taken to distribute among Soviet aviation authorities leaflets (in Russian) giving details of the Caravelle jet transport and the Armagnac itself.

* * *

Although the 1956 Olympic Games, to be held at Melbourne, do not begin until November 22nd, 1956, Qantas Empire Airways have announced that all seats have been reserved on services scheduled to operate between North America and Australia during the period preceding the Games. It is expected that international air traffic attracted to Australia by the Games will amount to some 200 flights, carrying over 10,000 passengers.

* * *

In a new *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft* (No. 47, issue 1), the A.R.B. emphasizes that passenger safety belts "are approved as types but can be and are supplied in a variety of lengths to suit particular seats and installations." Great care must be taken, says the notice, that, when seats are changed or new belts fitted, the belt has sufficient adjustment to give adequate restraint to all likely users, including children. The notice follows a recent accident investigation, when it was found that several seats were fitted with belts which could not be tightened enough to restrain the occupants.



Two views of the Eolo 3-V-1, a promising new Italian sailplane described on this page.

Civil Aviation

CLUB AND GLIDING NEWS

WORK on the Cambridge Private Flying Group's new lecture room at Cambridge Airport is now complete, and organized ground instruction is again in full swing. Messrs. W. Reeve, G. Watson and R. T. Evans have achieved first solos, and Mr. Ivor Barnes has gained his P.P.L. For members who have gained their P.P.L.s on the group's Tiger Moth, Mr. C. R. Brown's Auster 5, G-ANIO, is proving a popular attraction. Telephone number of the clubhouse is now Teversham 343.

NIGHT flying on Thursday evenings has begun at the Fair Oaks Aero Club, where September's flying hours totalled 414. New P.P.L.s were obtained during the month by Miss Dillon-Trenchard, Messrs. Slater, Bower, Bottomer, Lofting, Dodd and Braithwaite, Sen. Cdt. Cocks and Cdt. Cpl. Gorton. First solos were made by club members Ben Jones (immediately on reaching the age of 17) and Lister, and Cadet Cherrington.

DURING September, Yeadon Aero Club members flew a total of 227 hours, bringing the 1955 total to date to 1,770—some 470 hours more than that for the whole of last year. First solos were made by M. A. Napier, W. K. Whiteoak, W. S. Holderness and Dr. J. B. Blomfield, and Cadet Cpl. D. J. Marsh obtained his P.P.L. The club's "at home" on September 4th proved highly successful.

WITH fairly good weather at Perth Aerodrome during September, the Strathtay Aero Club logged a total of 143 flying hours. Two new P.P.L.s were obtained during the month.

A NEW Works Flying Club is being formed by the employees of Armstrong Whitworth Aircraft, Coventry. Following a meeting on September 29th, a tentative committee has been formed, which is now looking into the questions of hangar and clubhouse accommodation and maintenance. The new club has received much advice and assistance in its formation from the A.S. Flying Club (comprising employees of Armstrong Siddeley Motors), which has been in existence for the last three years.

FINALS of the annual club competitions at Elstree were held this year on September 4th, finishing with a supper patrol and a party in the evening. During the party the various trophies were awarded, with the Championship Trophy going to the pilot gaining the highest number of marks in all the contests. This year's champion was Miss Audrey Windle, with 1954 winner George Moore a close second. In the individual contests, Miss Windle won those for technical knowledge (after a tie with C. O. Vernon) and for landing; while Mr. Moore was successful in the circuit and navigation competitions. Best student pilot of the year was J. P. Boucher.

Elstree's plans for the future include a motor rally on October 23rd, a Guy Fawkes party on November 2nd, the Brooklands Flying Club reunion on November 18th, a revival of the winter ground-instruction lectures and a Christmas dinner. First arrangements are being made also for a series of competitions between the Denham, Elstree and Surrey Flying Clubs.

TWELVE members of the Coventry Aeroplane Club at Baginton are currently under instruction. September proved a successful month, 95 hours being flown in the club Tiger Moth and Auster. The second Tiger, G-ALUC, is now operational again after completion of its C. of A. overhaul. Two P.P.L.s were obtained during last month, and three first solos were logged.

ELEGANT, Italian, and a likely contender in next year's World Gliding Championships, the Eolo 3-V-1 high-performance sailplane shown above has been designed by the sporting gliding club of the SIAI Marchetti works. As on most contemporary sailplanes in the high-performance class, laminar profiles have been chosen for the wing, which is of 20 m span. Among the design features intended to avoid wing distortion are the use of very thick plywood skinning at the leading edge, and widely spaced ribs. Aspect ratio is 25, and slotted high-lift flaps are incorporated. The inner sections of the ailerons, also, can be drooped to provide extra lift. Fan-type spoilers of 2.8 m total span are fitted to the upper surface of the wing at 50 per cent chord, and tip losses are reduced by small fairings at the tips of both wings and tailplane.

In the ply-covered fuselage, the cockpit appears well positioned to provide good visibility, and provision is made for radio and oxygen equipment. A water tank of 46 litres capacity enables the wing-loading to be varied if required. A single retractable landing wheel is mounted ahead of the centre of gravity; no forward skid is fitted, the lower front fuselage being externally reinforced. The vee tail is controlled differentially, with the rudder function so regulated (the designers state) to give the same stability as a conventional rudder, but with less drag.

Dimensions and performance data of the Eolo 3-V-1 include: empty weight, 615 lb; useful load, 265 lb; normal all-up weight, 880 lb; all-up weight with ballast, 990 lb; wing area, 172 sq ft; wing loading, 5.1 lb/sq ft (normal), 5.75 lb/sq ft (maximum). Performance at 990 lb: minimum sink, 1.77 ft/sec at 51 m.p.h.; sinking speed at 62 m.p.h., 2.3 ft/sec; landing speed with full flap and drooped ailerons, 31 m.p.h.

THREE gliders have been acquired by the recently formed Perkins Gliding Club, founded by employees of a Peterborough diesel-engine company. In addition to these aircraft—two Kirby Cadets and a Tutor—it is hoped to obtain a two-seater in the near future for *ab initio* training. Chairman and chief flying instructor of the club are Mr. Tony Leonard and Mr. L. Holton respectively; membership at present is 110, of whom 18 have previous gliding experience. The club is negotiating for the use of the local Westwood Aerodrome, and hopes to begin flying early next year.

THE first issue of *Sailplane and Gliding*, the new official organ of the British Gliding Association, is published this month. It is in effect a combination of the previous B.G.A. quarterly *Gliding* and the magazine *Sailplane and Glider*, and will be published bi-monthly at 2s 6d. Among the contents of the first issue of the new journal are *37,000ft at Bishop*, by Cdr. Nicholas Goodhart, *Gliding in Japan*, by Lt.-Col. N. J. Dickson, and *The French Nationals at St. Yan*, by Geoffrey Stephenson.

R.Ae.C. PILOTS' CERTIFICATES, JULY-SEPTEMBER

No.	Name	Cl.	Date	No.	Name	Cl.	Date
28,694	D. Brook	4	18/7/55	28,704	J. Hübner	1	15/8/55
28,695	H. Armitage	1	18/7/55	28,705	F. A. Gutkind	2	16/8/55
28,696	C. F. Vine	4	19/7/55	28,706	R. B. Pickett	1	23/8/55
28,697	S. E. Hamsley	4	19/7/55	28,707	M. J. C. Odell	3	24/8/55
28,698	A. Reeves	1	19/7/55	28,708	W. T. J. Baines	4	9/9/55
28,699	P. Hill	3	19/7/55	28,709	P. H. Yarde	4	13/9/55
28,700	F. C. V. Hopkins	2	22/7/55	28,710	E. M. Joannides	1	21/9/55
				28,711	S. E. S. Smith	4	27/9/55
28,701	L. M. Henry	2	29/7/55	28,712	J. M. S. Procter	3	27/9/55
28,702	J. V. Hadland	1	9/8/55				
28,703	W. W. Hall	4	12/8/55				

Contestants for the Medium-haul Market

Vanguard, Electra, Viscount or Metropolitan? The Choice Before the World's Carriers

LAST Monday's announcement (see pages 650-651) of the Vickers-Armstrongs 900, or Vanguard as it has been named by B.E.A., calls for a review of the airliners competing for the favours of the world's medium-haul operators whose 1,500-2,000 airliners carry at least half of air transport's annual ton-miles. Two—the Vickers Vanguard and the Lockheed Electra—are as yet untested, while the Vickers Viscount 700 and 800 and the Convair 440 Metropolitan may be regarded as service-tested, familiar designs.

The **Vickers V.900 Vanguard** (four Rolls-Royce RB.109 Tyne turboprops and the **Lockheed 188 Electra** (four Allison 501-D10 turboprops) have one significant factor in common: they have established a new conception of the medium-haul airliner. Both are big—in the 100,000 lb class—with large-capacity fuselages for 70 to 100 passengers, and both have range-bands extending to the 2,000 mile-plus mark. Five years ago they would have been classed as long-haulers. But it is not the product that changes the market, although this does sometimes happen; more often it is the market which, developing naturally, calls for a change in the product. Vickers-Armstrongs and Lockheed would be the first to confirm the influence that two of the world's most experienced medium-haul carriers, British European Airways and American Airlines, have had on the respective specifications of the Vanguard and the Electra.

It has been convenient to regard medium-haul carriers as specialists in 500-1,500 mile domestic or regional sectors—plus or minus a few hundred miles. The traffic has been carried largely by some 350 forty-passenger Convair 240s and 340s, the similar-sized Viscount, with its great appeal, coming spectacularly into prominence during the past two years. But the remarkable rate at which air traffic is growing—20 per cent each year—cannot be met most economically simply by expanding fleets; for best efficiency the size of the vehicle has to increase accordingly. This, of course, is happening in the long-haul business, with the new contenders—the Douglas DC-8, the Boeing 707 Stratoliner, and (we presume) the new B.E.25-powered thin-wing, Bristol Britannia—all in the 150,000 to 250,000 lb, 100- to 150-passenger class.

Medium-stage traffic is actually expanding at slightly more than the average 20 per cent rate for the whole industry, but it is experiencing also a shift in the distribution of that traffic; the tendency is towards higher densities on the shorter routes—i.e., 250 to 500 miles. This is the fundamental fact behind the medium-haulers' requirement for the bigger vehicle, which has resulted in the evolution of the Vickers Vanguard and the Lockheed Electra.

The remarkable thing about both aircraft, however, is the wide scope of their range-capabilities. Their designers have recognized the significant tendency for medium-haul airlines to extend the frontiers of their upper ranges into the territories of the long-haulers, who in turn are looking toward really long-distance, end-to-end overflying operations. Both Vanguard and Electra are being marketed with the promise of range-capabilities extending to more than 2,000 miles.

The **Vickers Viscount** (both 700 and 800) and the **Convair 440 Metropolitan** have in common something that, in the consideration of operators who need to expand their fleets more or less immediately, give them an advantage over the Vanguard and the Electra: their operational and engineering qualities are proved, and they are available earlier. The Metropolitan, being an old 340 candy in a new wrapper, is available on a six months' delivery, a fact which has influenced S.A.S., Sabena and Swissair in their surprising decisions to order; no doubt the fact that these European operators are already stocked with Convair 340 and Pratt and Whitney R-2800 parts and equipment was a consideration also, as well as the fact that on very short domestic sectors—averaging, say, about 300 miles—the piston-driven airliner is undoubtedly slightly cheaper to operate than the turboprop. New impetus has been given to a production line slowed down by Viscount sales (although steadily moving on the strength of U.S. military orders), but it would be unrealistic to regard the Metropolitan as a serious world challenger to the Viscount, if only on the judgment of today's turboprop-conscious passengers. One wonders at the effect of a turboprop Convair 340 on the market, and there is a very strong case to be made out for the Eland-powered version—now being engineered by Napiers—which if developed in time will be a most formidable contestant.

The Viscount has, more than any other design, set the pace of medium-haul airliner development, and has formulated a new taste in public standards of air travel. Its appeal to world operators—22 of whom have already chosen it—was further extended by the announcement last Monday (coinciding with first news of the Vanguard) that the 700 and 800 models are to have improved performance. The two models, which were designed to operate in partnership (the 800, or "Major," is a short-range, high-payload version of the 700), differ only in fuselage-size, the cabin of the 800 being 9ft 3in longer than that of the 700 to accommodate the additional payload. Both models are to benefit markedly in payload-range performance and speed by the fitting of the latest Rolls-Royce Darts, type RDa.7, of 2,100 s.h.p. down-rated to 1,700 s.h.p. for take-off—an increase in cruising power of over 300 s.h.p. over the RDa.6 on which figures were previously based. And on Monday came news of a yet further improved 400 m.p.h. Viscount, to take the developed Dart RDa.8 of some 2,500 s.h.p.

We have made no mention of other airliners that may influence the market to a greater or a lesser degree. The massive re-equipment programmes in which the long-haulers are indulging are bound to release quantities of second-hand 749 Constellations and DC-6s, whose capacities and flexibility of range will match well the developing requirements of the medium-haulers, especially those with domestic routes not immediately threatened by turboprop competition. One takes for granted the decisive superiority of the turboprop, while overlooking the need of many operators to get more ton-mile capacity quickly, regardless of whether the customers prefer turboprop travel or not.

There is only one jet contender, the **S.E. Caravelle** (two Rolls-Royce Avon RA.26s), the de Havilland Comet 4 being essentially a long-hauler. The Caravelle, while less versatile operationally than its rivals, is certain to draw the traffic on selected 1,000-mile-plus routes where its speed will show to best advantage.

To sum up, the bulk of the traffic over the world's medium stages, say 250 to 1,750 miles, will be competed for over the next decade by four basic types of aircraft and their developments: the Vickers V.900 Vanguard, the Lockheed Model 188 Electra, the new Vickers Viscount 700 and 800, and the Convair 440 Metropolitan. The first two are advanced designs, for delivery three to five years hence; the latter two are in production now. In considering the chances of each for big world sales, the choice between the Vanguard and the Electra seems likely to depend on the prospects of the Rolls-Royce Tyne and the Allison 501-D10 (T56), with the odds heavily in favour of the Tyne. The Viscount-Metropolitan tussle is essentially one between a product that is decisively superior operationally, and another that can be bought earlier. It seems certain that the judgment of history will give the verdict to the turboprops. J. M. R.

SIX MEDIUM-RANGE TYPES: COMPARATIVE DATA (ROUND FIGURES)

Aircraft	Seats	Gross weight (lb)	Take-off s.s.h.p.	Total fuel (lb)	Max. payload (lb)	Max. payload range (with reserves) (st. m.)	Cruising speed (m.p.h.)	Approx. price (£)	Numbers sold to date
Vickers V.900 Vanguard (4 Rolls-Royce RB.109 Tyne)	93-105	110,000 (approx.)	4 × 4,400 (approx.)	Not announced	21,000	2,000 plus	425	750,000	20
Lockheed 188 Electra (4 Allison 501-D10)	64-90	98,500	4 × 3,750	26,670	18,000	1,850	415	550,000 (less engines)	75
Vickers Viscount 700	40-59	62,000	4 × 1,800	12,900	950	365	350,000	239
Vickers Viscount 800 (4 Rolls-Royce Dart RDa.7)	44-70	65,000		14,200	860	360		
Convair 440 Metropolitan (2 Pratt and Whitney R-2800 CB17)	44-52	49,100	2 × 2,500	11,300	12,700	1,200	275	300,000	46
S.N.C.A.S.E. 210 Caravelle (2 Rolls-Royce RA.26)	70-91	90,000	2 × 10,000 lb (st. thrust)	33,500	20,900	1,300	450	440,000	—

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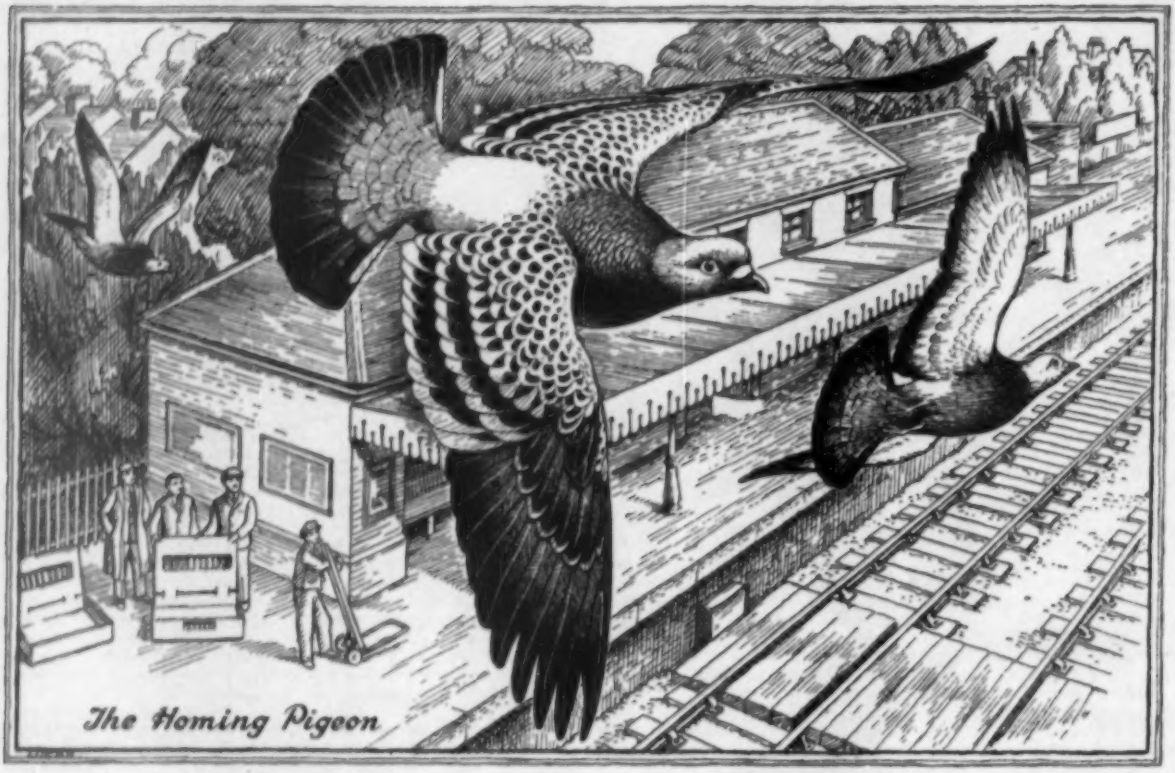

ON THE BEAM

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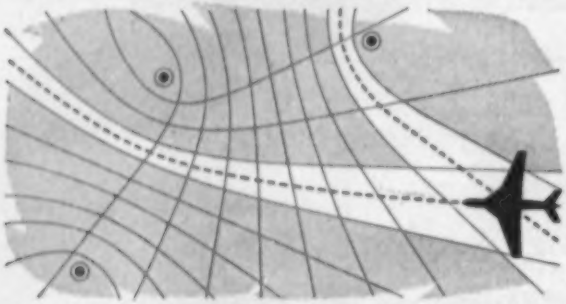

Butterflies cross seas and make safe landfalls; the Chinook salmon swims oceans and returns, infallibly, to the very pool of the very river in which he was born; a pair of finches divide their year, season after season, in a particular bush in an English garden and another in a North African orchard. Most astonishing of all, the homing pigeon can be taken in any direction, for any distance, and after a turn or two in the air will fly unhesitatingly straight for home.

How does the pigeon do it? We do not know. We may never know. It is not sight, nor smell. If it is sense of direction, this must be developed to a degree of sensitive infallibility which puts it clear beyond human understanding. We can only say that—like hundreds of kinds of migratory creatures—the pigeon feels some mysterious, unmistakable pull towards home: that he senses some "radio beam" that gives him his direction.

Though we may never know the mechanics of the homing pigeon's "beam", we imitate its effects. Landing under any but the best daylight conditions can be difficult indeed without this navigational aid we have copied from Nature.

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Three New Standards

THE presentation of three standards, to Nos. 35 and 36 Sqns. and to No. 1 Field Sqn., R.A.F. Regt., is announced by the Air Ministry.

No. 35 Sqn. was formed in 1917 and saw service on the Western Front where it co-operated with the Cavalry Corps. Hence the squadron badge includes a winged horse's head. In World War 2, No. 35 carried out daylight and night bombing attacks, including raids on the *Scharnhorst* and *Tirpitz*. It was one of the first four squadrons in Pathfinder Force. No. 36 Sqn. was formed in 1916 for home defence duties. It joined Coastal Command in 1928, and was in Malaya at the time of the Japanese invasion, and fought subsequently in the Far East and the Mediterranean Theatre before rejoining Coastal Command in the South West Approaches in 1944.

No. 1 Field Sqn., R.A.F. Regt., was formed in Egypt in 1921 as No. 1 Armoured Car Company. It fought during the disturbances in 1922 on the Kurdistan frontier. Since that time the squadron has been engaged in action in Palestine (1936); in Habbaniya (1941); in the Western Desert (1941-1943) and in Mosul. In 1945 it returned to Habbaniya.

Shackletons on Tour

FOUR Shackletons of No. 228 Sqn., St. Eval, are to leave on October 20th for a training and goodwill tour of Brazil, Venezuela and Columbia. They will cross the Atlantic *via* Gibraltar and Dakar and return *via* Kingston, Jamaica, Bermuda, and the Azores. The aircraft are due back at St. Eval on November 13th.

The force commander will be A.V-M. G. W. Tuttle, A.O.C. No. 19 Group, Coastal Command. His deputy will be W/C. R. E. Craven, O.C., Flying, at St. Eval. Each Shackleton—they will all be Mk IIs—will carry a crew of ten and all ground crew required for maintenance.

In the Western Hemisphere air displays and demonstration flights will be given, and at Caracas the force will be inspected by the president of Venezuela. At Kingston, Jamaica, and Bermuda, the team will carry out maritime-air exercises with the West Indies Squadron, and at Key West similar exercises will take place in conjunction with the U.S. Navy.

Hunters to Scandinavia

THE 16 Hunters of No. 43 Sqn., Leuchars, are at present on a visit to the Royal Norwegian and Royal Swedish Air Forces. Earlier this week, Air Marshal Sir Dermot Boyle, A.O.C-in-C. Fighter Command, was to fly to Norway to join the squadron at Oslo. He was to be accompanied by A.V-M. W. G. Cheshire, A.O.C. No. 13 Group, and A.Cdre. P. H. Dunn, air commodore in charge of operations at Fighter Command.

It was No. 43 Sqn. which, under the command of S/L. R. E. Le Long, carried out the intensive flying trials of the Hunter at Leuchars earlier this year. They completed the task in four days less than the 60 days originally allotted for it. The squadron's aerobatic team of four aircraft is giving displays over Oslo and Stockholm. They were to fly to Gadermoen, Oslo, yesterday *via* Sylt and Wattisham. In Sweden they are visiting Tullinge, near Stockholm, and are to return on Sunday, *via* Göteborg and Jever, Germany.

Visits between the three air forces have been exchanged regularly since the war.

The second pilot's view from a Shackleton of the summit of Ben Nevis, highest mountain in Britain (altitude 4,406ft). Both pilots sit in line with the inner contraprops.

R.A.F. Wins Britannia Shield

BY winning the boxing finals at the Empire Pool, Wembley, on October 5th, the R.A.F. emerged victorious from the tenth Britannia Shield competition. The swimming event had earlier been won by the R.A.F. with 54 points, their nearest rivals being the U.S.A.F. with 49 points. Norway won the shooting event with 717 points, the R.A.F. score being 703. The fencing was won by Belgium, with 25 points, whereas the R.A.F. secured only 11½. Before the boxing events France, the former holder of the Shield, withdrew after a dispute concerning judging.

Results of the boxing were:

Flyweight.—A/2C. S. Rhodes (U.S.) beat A/C. B. Lloyd (R.A.F.) on points.

Lightweight. — L.A/C. R. McTaggart (R.A.F.) beat Sailor W. D. Gerlach (Netherlands) on points.

Light-Welterweight.—Sailor J. Verhagen (Netherlands) beat Pte. G. Gobin (Belgium) on points.

Light-Middleweight. — A/2C. F. Davis (U.S.) beat L.A/C. J. Cunningham (R.A.F.). Referee stopped fight in first round.

Middleweight.—Pte. van. Berkum (Netherlands) beat L.A/C. L. Mullen (R.A.F.) on points.

Light-Heavyweight.—L.A/C. P. Spearman (R.A.F.) beat A/2C. S. S. Banks (U.S.). Referee stopped fight in third round.

Heavyweight.—A/2C. J. Hemphill (U.S.) knocked out Pte. T. Nokin (Belgium) in the first round.

Final Placings.—R.A.F., 81½ points, 1; U.S., 66, 2; Belgium, 61, 3; Netherlands, 56½, 4; Norway, 56, 5.

Recommissioning by Air

NEXT month a complete new crew totalling 750 men will be flown from Britain to Singapore to man the cruiser *Newcastle*. The present crew will be flown home for Christmas. This is the first occasion on which a cruiser has been recommissioned in this way. Handley Page Hermes aircraft will be used.

Awards

THE following awards have recently been announced in the *London Gazette*:—

For service in Malaya:—

D.F.C.: S/L. B. V. Kerwin, No. 48 Squadron; S/L. S. J. Rawlins, No. 52 Squadron; S/L. B. H. Walker, No. 148 Squadron; F/O. C. J. Calvert, No. 52 Squadron; F/O. P. Gray, No. 48 Squadron; F/L. M. E. J. Hickmott, No. 267 Squadron.

O.B.E.: W/C. B. Barthold, Air Headquarters, Malaya; W/C. A. G. Wilson, D.F.C., R.A.F. Station, Butterworth; W/C. D. P. Marvin, D.F.C., R.A.F. Station, Changi; W/C. G. H. Wherry, D.F.C., Headquarters, F.E.A.F.; W/C. R. A. L. Morant, Headquarters, F.E.A.F.; S/L. R. G. Milton, A.F.C., Air Headquarters, Singapore.

B.E.M.: F/Sgt. W. V. Burns, R.A.F. Station, Changi.

Naval Personnel: **D.F.C.:** Lt-Cdr. M. W. Wotherspoon, R.N., No. 848 Squadron; Capt. D. W. Smith, Royal Regiment of Artillery, No. 656 (AOP/LL) Squadron.

For service in Kenya:—

D.F.C.: F/O. J. Sherburn, No. 1340 Flight, British Forces, Aden.

D.F.M.: F/Sgt. J. F. E. Erasmus, No. 1340 Flight, British Forces, Aden.

O.B.E.: W/C. C. P. N. Newman, D.F.C., Joint Operations Centre, General Headquarters (East Africa); S/L. N. Kirby, R.A.F. Station, Eastleigh; S/L. K. R. Bowhill, R.A.F. Station, Eastleigh.

M.B.E.: F/L. W. T. Kitchin, R.A.F. Station, Eastleigh.

B.E.M.: Cpl. W. Butler, No. 1340 Flight, British Forces, Aden; F/Sgt. B. Turner, No. 49 Squadron.

For service in Cyprus:—

B.E.M.: Acting Cpl. M. O'Connor, No. 264 Signals Unit.

Reunion

NO. 225 SQUADRON will hold its tenth reunion at the New Norfolk Hotel, London Street, Paddington, London, W.2, on Saturday, October 22nd, at 6.30 p.m. Tickets, price 7s 6d, from J. O. Lupton, 16 Rosedale Road, Heaton Chapel, Stockport, Cheshire.

Service Aviation

R.A.F. AUSTERS for the ANTARCTIC

Seen airborne near Rearsby, the Auster Mk 7 for the Trans-Antarctic Expedition displays some of its special features. Painted bright orange to show up in snow, it has A.D.F. aerial dome, discharge wicks and a special undercarriage, as well as less-obvious special equipment.

EXPEDITIONS to the snowy wastes near the South Pole are very much in fashion nowadays. While the Americans are preparing to explore certain regions of Antarctica during the International Geophysical Year, a joint Commonwealth expedition is making ready to cross Antarctica at about the same time; and, as related on p. 658, a survey of the Grahamsland Peninsula is soon to begin. Preparations for any such venture, however, take a long time, and a great deal of new equipment has to be tested in advance. An important part of the equipment of what has been called the Trans-Antarctic Expedition will be two Austers which are intended for use in general reconnaissance and transport duties.

The Auster is no newcomer to these frigid regions, for Mk 6s were active there with the Falkland Island Dependencies survey expedition in 1949-1950. The pilot concerned at that time was S/L. J. H. Lewis, R.A.F., and he is to take part in the Trans-Antarctic venture as well. He is to be accompanied by S/L. J. R. Claydon, R.N.Z.A.F., F/Sgt. P. D. Weston, R.A.F. (also an Antarctic veteran), and Sgt. Williams, R.A.F. The team is now at Rearsby, sorting, checking and repacking a great quantity of equipment which will accompany them on a preparatory expedition this winter. In addition to providing two Austers (extensively modified by Auster Aircraft, Ltd.), the Royal Air Force has accepted responsibility for all the radio equipment to be used for communication both between England and the expedition and between the various teams. Next year, two more pilots will join the R.A.F. contingent.

Auster Aircraft have now completed the modification and testing of the two aircraft—Mk 7 trainers returned to them for this purpose by the R.A.F. The aircraft will be powered by a Gipsy Major Mk 7G engine, fitted with the Plessey six-shot cartridge starter, an oil-dilution system and a 24v 500W generator. The oil cooler has been eliminated and a normal exhaust-muff heater added.

As the aircraft will have to operate on floats for part of the time, a considerable effort has been made to lighten the structure as much as possible; extensive radio equipment has made this all the more necessary. To this end, therefore, the fabric covering has been removed and replaced by the lighter fabric used for civil Austers and finished in a bright orange dope to make the aircraft visible against snow. The self-sealing tanks have been replaced by the lighter 16 gal civil versions and a standard 13-gal belly tank attached. The fuel capacity of 45 gal thus allows an endurance in the region of six hours.

For use with skis, Austers have fitted special undercarriage legs using rubber discs in compression. Wheels and brakes are fitted only for tests in England.

The wheel undercarriage would be of no use in the Antarctic and it has been fitted only for testing at Rearsby. During the expedition, a new undercarriage-leg arrangement with rubber disc shock-absorption will carry special skis, the runners of which are made of a laminated fabric sheet, grade F1080, designed to resist abrasion. Wheel brakes have been removed and replaced by a cable-control by which the water rudders at the tail of the floats can be retracted for beaching. The floats themselves were designed and made by Auster's and are the same as those used in previous expeditions. To give greater directional stability when floats are fitted, an aerodynamically balanced rudder (similar to that of the Autocar) is provided, together with an extra fin under the tail. To resist extremely low temperature, oversize very soft rubber grommets have been fitted round the Perspex transparencies.

One of the greatest problems of Antarctic flying is, of course, navigation, and use of a magnetic compass immediately involves difficulties. The variation over much of the Antarctic has never been accurately plotted, and some attempt will be made during the expedition to fill in at least some of the gaps in this knowledge. The Austers will therefore rely primarily on a Bendix Polar Path stable gyro which precesses only about 2 deg per hour. In addition, a landing compass, an astro compass and a sun compass will be carried; and considerable use can, of course, be made of the aircraft's Marconi AD. 7092 A.D.F. and of the Marconi AD. 97/108 lightweight communications radio, with a stick aerial mounted on top of the cabin, and a 150-ft trailing aerial which is streamed on a small plastic drogue over the top of the rudder. Both Austers have discharger wicks on rudder and ailerons.

The R.A.F. will sail for the Antarctic next month with one Auster crated as a spare and the other mounted on floats and lashed on deck. They will be embarked in the tiny Canadian sealer *Theron* for the journey to the Falkland Island Dependencies. Their main duty will be to guide the ship through pack ice by providing air reconnaissance and to test and gain experience of the equipment they have with them. After seven months they will return to England before finally starting in November 1956 on the Trans-Antarctic Expedition proper. At that time they will be joined by some D.H.C. Beavers and Otters working from the New Zealand side of the Antarctic.

(Left) The Auster - built floats test - assembled. (Right) The three pilots, (l. to r.) S/L. Lewis, S/L. Claydon, R.N.Z.A.F., and (flying on the first expedition) F/L. G. M. Haslop.

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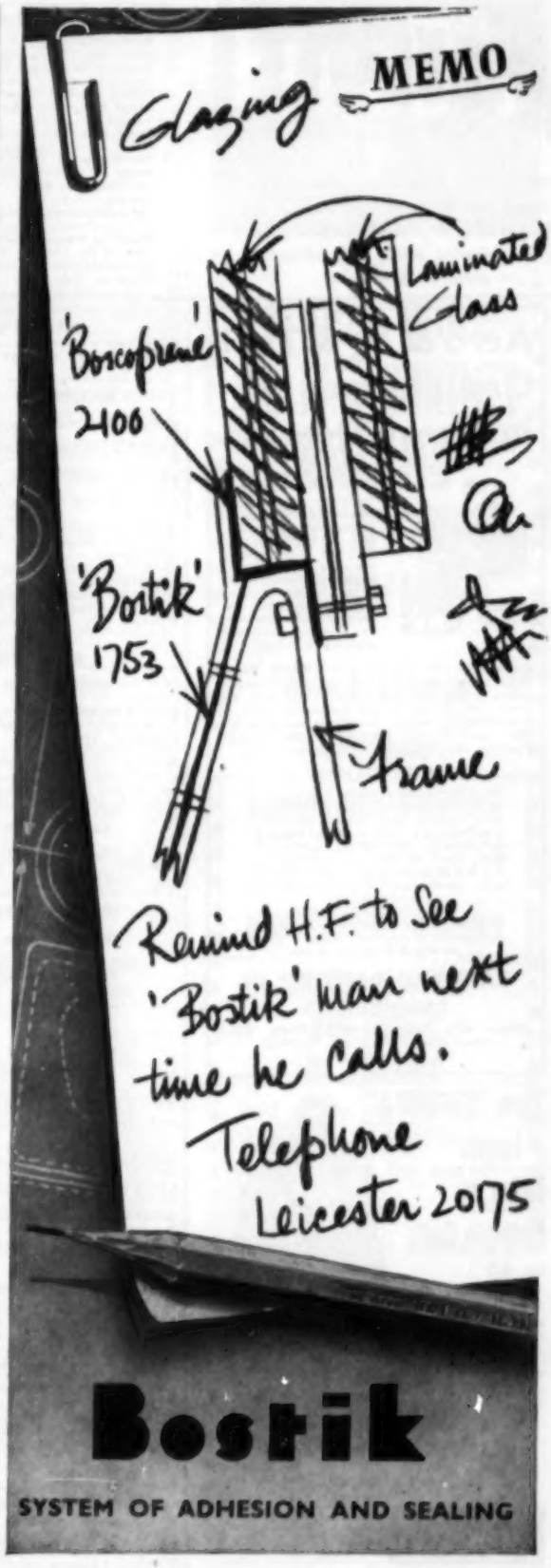

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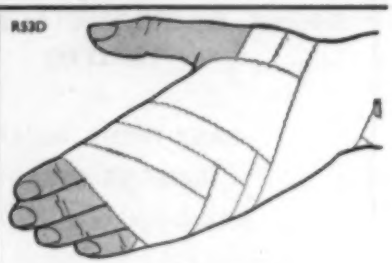

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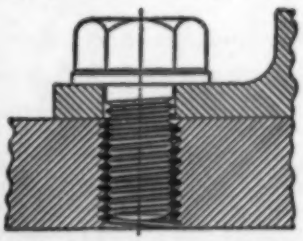

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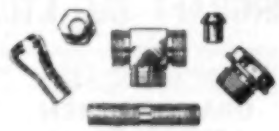

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WYLIE. On October 10th, 1955, at a Nursing Home in Perth, Australia, Hamilton Neil Wylie, B.Sc., M.B.E., F.R.Ae.S., late of London and Edinburgh. [4372

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:

FROM Air Kruise (Kent), Ltd., of 1, Great Cumberland Place, London, W.1:

APPLICATION No. 11/2. For permission to use Bristol 170 aircraft throughout the period of approval, in addition to the aircraft types already authorised, on the Normal Scheduled Services between Lydd and Le Touquet, Ostend and Calais respectively, (Applications Nos. 11, 29 and 226) which the Company have been approved to operate until 1960, and also on the Inclusive Tour Services which they have applied to operate to Luxembourg from Lydd (Applications Nos. 574, 579, 621 and 622) and from Manchester (Application No. 590).

APPLICATION No. 364/1. For permission to extend from 31st October, 1955, to 29th February, 1956, at a reduced frequency of one return flight per week operated on Wednesdays the Inclusive Tour Service between Lydd and Basle (Application No. 364) which the Company are at present approved to operate until the former date with Dakota aircraft in conjunction with Blue Cars (Continental) Coach Cruises, Ltd.

APPLICATION No. 650. For a Normal Scheduled Service to be operated with Dakota, Bristol 170 and later possibly with Herald aircraft for the carriage of passengers, supplementary freight and mail between Lydd and Luxembourg (Sandweiler) at a frequency of up to three return flights daily for a period of 10 years commencing April, 1956.

APPLICATION No. 651. From British European Airways Corporation of Keyline House, Ruislip, Middlesex, for a Normal Scheduled Service to be operated with Viscount and Elizabethan aircraft for the carriage of passengers, supplementary freight and mail between Manchester and Rome with an optional intermediate traffic stop at London Airport at a frequency in accordance with traffic demand for a period of 10 years commencing 1st April, 1956.

FROM Eagle Aviation, Ltd., of 29 Clarges Street, London, W.1, for Seasonal Inclusive Tour Services to be operated with Viking and Dakota aircraft for the carriage of passengers and supplementary freight for a period of seven years, commencing 1st May, 1956:

APPLICATION No. 652. For a service in conjunction with Wenger Airtours, Ltd., between London (Blackbushe) and Palma, at a frequency of one return flight weekly to be operated on Saturdays or Sundays during the season from May to October inclusive each year.

APPLICATION No. 656. For a service with Tartan Arrow (Continental), Ltd., between London (Blackbushe) and Palma at a frequency of one return flight weekly to be operated on Saturdays or Sundays during the season from May to September inclusive each year.

APPLICATION No. 657. For a service in conjunction with Tartan Arrow (Continental), Ltd., between London (Blackbushe) and Palma at a frequency

(Continued at top of column 2, page 37)

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PUBLIC ANNOUNCEMENTS

(Continued from foot of column 2, page 36)

of one return flight weekly to be operated on Saturdays or Sundays during the season from May to September inclusive each year.

FROM Lancashire Aircraft Corporation, Ltd., of 7, Berkeley Street, London, W.1, for the following Seasonal Inclusive Tour Services to be operated with Dakota aircraft in conjunction with Air-Coach, Ltd., for the carriage of passengers and supplementary freight for a period of seven years:

APPLICATION No. 653. For a service between Blackpool (Squires Gate), Liverpool (Speke) and Beauvais (Tille) at a frequency of up to four return flights weekly, to be operated on Mondays, Tuesdays and Wednesdays, during the season from May to September each year, commencing 7th May, 1956.

APPLICATION No. 654. For a service between Blackpool (Squires Gate), Southend and Strasbourg (Entzheim) at a frequency of up to two return flights weekly, to be operated on Sundays, during the season from second Sunday in May to the first Sunday in October inclusive each year, commencing 13th May, 1956.

APPLICATION No. 655. From Silver City Airways, Ltd., of 1, Great Cumberland Place, London, W.1, for a Normal Scheduled Service to be operated with Dakota aircraft for the carriage of passengers, supplementary freight and mail betwen Southampton (Eastleigh) and Le Havre at a frequency of up to nine return flights weekly for a period of 10 years, commencing 1st March, 1956.

APPLICATION No. 85/1. From Airwork, Ltd., of 15 Chesterfield Street, London, W.1, for an amendment to the terms of approval of the Colonial Coach Class Service which the Company are approved to operate with Viking aircraft between London and Nairobi at a frequency of one return flight weekly for the period up to 20th February, 1960, so as to operate two additional return flights monthly.

THESE applications will be considered by the Council under the Terms of reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question. Their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections.

THE Air Transport Advisory Council also give notice that the following application has been withdrawn:

APPLICATION No. 599. From Dan-Air Services, Ltd., of Bilbao House, 36/38 New Broad Street, London, E.C.2, for an Inclusive Tour Service in conjunction with Arrowsmith Holidays, Ltd., between London (Blackbushe) and Perpignan. This application was advertised in "The Times," "The Aeroplane" and "Flight" on 9th September, 1955. [4371

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DETAIL DRAUGHTSMEN

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A Chief Dynamics Engineer is required by a large organisation in the Guided Weapons industry. Applicants must have a degree and should preferably have five to seven years experience in the field of dynamics.

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An important Company, engaged in the design and development of major guided weapon projects, require a Senior Mechanical Engineer to take charge of a team concerned with the ground equipment, packaging and power supply unit aspect of this work.

Applicants should have a university degree in mechanical engineering, and considerable experience in the design of mechanical equipment. Some knowledge of solid propellents and explosives would be an advantage.

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Graduates in engineering or physics are required by Armstrong Whitworth for interesting work associated with guided weapon flight trials. Applicants are required to work on the development of environmental testing techniques and on the development of suitable equipment to simulate a wide range of operating conditions.

Technical Assistants are also required for the same work. Here, either Ordinary or Higher National standard is required, and the work will consist mainly in operating the equipment described above.

For all of these posts experience of development testing or type testing would be an advantage, and some experience in operating electrical and electronic equipment would be desirable. Some of the posts entail occasional visits to the missile firing ranges.

All applications should be addressed to the

Staff Employment Officer, Armaments Division,

Sir W. G. Armstrong Whitworth Aircraft Ltd.

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PROJECT LEADER

A Project Leader is required by an important Company, engaged in the design and development of major guided weapon projects, to lead a team of engineers engaged in the development of mechanical aspects of guided weapons and associated equipment.

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Two vacancies exist in an important Company, engaged in the design and development of major guided weapon projects, for Electronic and Electrical Engineers with a degree or equivalent qualifications, and a minimum of seven years experience in either research and development or design.

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These appointments are superannuable.

The Companies' Technical Staff salary range offers attractive starting salaries and good prospects of future advancement. The more senior technical appointments carry monthly staff status with salary scales that extend into the four figure range.

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This post is a senior position of considerable responsibility, and carries a high salary. Applications will be treated in strictest confidence, and should be addressed in the first instance to the

Staff Employment Officer, Box No. 6693, c/o "Flight."

SENIOR DESIGNER

A Senior Designer is required to take charge of a section of an important Company, engaged in the design and development of major guided weapon projects, devoted to the mechanical aspects of this subject.

Applicants should possess a university degree or equivalent qualification, and have had considerable experience in the design of aircraft structures. Ability for original thinking is essential.

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APPLICATIONS in the strictest confidence to Box 7039. [4361

MECHANICAL Designers and Draughtsmen required of all grades for both gas turbine and special purpose machine tool work. Experienced Checker also required. Salaries commensurate with experience and ability. Please write, Ref. D.37, Centrax Power Units, Ltd., Victoria Road, Feltham, Middlesex. [4356

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EXPERIMENTAL Instrument Designers are invited to join a new Company in Gloucestershire engaged on work of National importance. Applicants should have had experience in at least one of the following: pneumatic or electrical controllers, electronics, radio-isotopes applications. Please give full details of qualifications, age, and salary required. Our own staff are aware of this notice. Communications will be treated as strictly confidential. Box No. 7093. [4369

A VACANCY exists in our Redux Department for a Sales Engineer to assist with the promotion of our products in the Aircraft Industry. The ideal applicant will be about 25 years of age and will have served an apprenticeship in the aircraft industry. After a period of training he will be expected to travel widely and a knowledge of foreign languages will be an asset.

APPLICANTS should write, stating age and particulars of past record, to Aero Research Limited, Duxford, Cambridge. [4364

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AIRCRAFT INDUSTRY. Representative required by principal manufacturers in associated industry. Applicants, age 35/40, must be capable of top level negotiations and for preference already known in the aircraft industry. Total remuneration based on age and experience. Write, stating age, experience and remuneration envisaged, to Secretary, Box No. 7025. [4358

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MANUFACTURERS of gas turbine engines have vacancies for mechanical engineering draughtsmen interested in installation design. Ordinary National Certificate or Higher National Certificate in Mechanical Engineering an advantage although not essential. Age limits 19-28. Positions hold good prospects for young men willing to learn and work hard with commensurate salaries and pension scheme. Apply to Technical Personnel Officer quoting reference "Installation" to Box 6762. [4306

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BRITISH EUROPEAN AIRWAYS require a Technical Officer (Navigational Aids) at Northolt. Duties include investigation and development of navigational aid air and ground systems from operational aspect; progressing implementation of facilities with appropriate authorities. Essential qualifications: University degree or equivalent; sound knowledge of aircraft radio and radar navigational systems with experience in the analysis and evaluation of such systems. Salary scale £905—£1,120 p.a. Written applications to Personnel Officer, Flight Operations Department, B.E.A., Keyline House, Ruislip, Middlesex. [4354

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COLLECTION aviation books, etc., for sale. S.A.E. for list to Hudson, 10 Crest Road, S. Croydon, Sy. [4359

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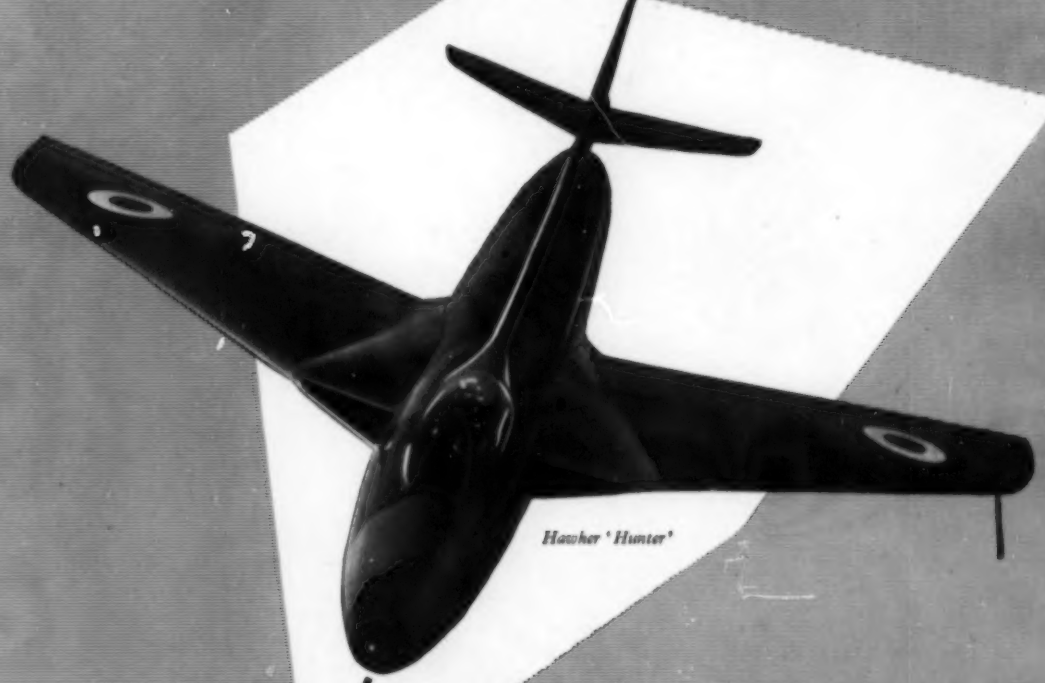

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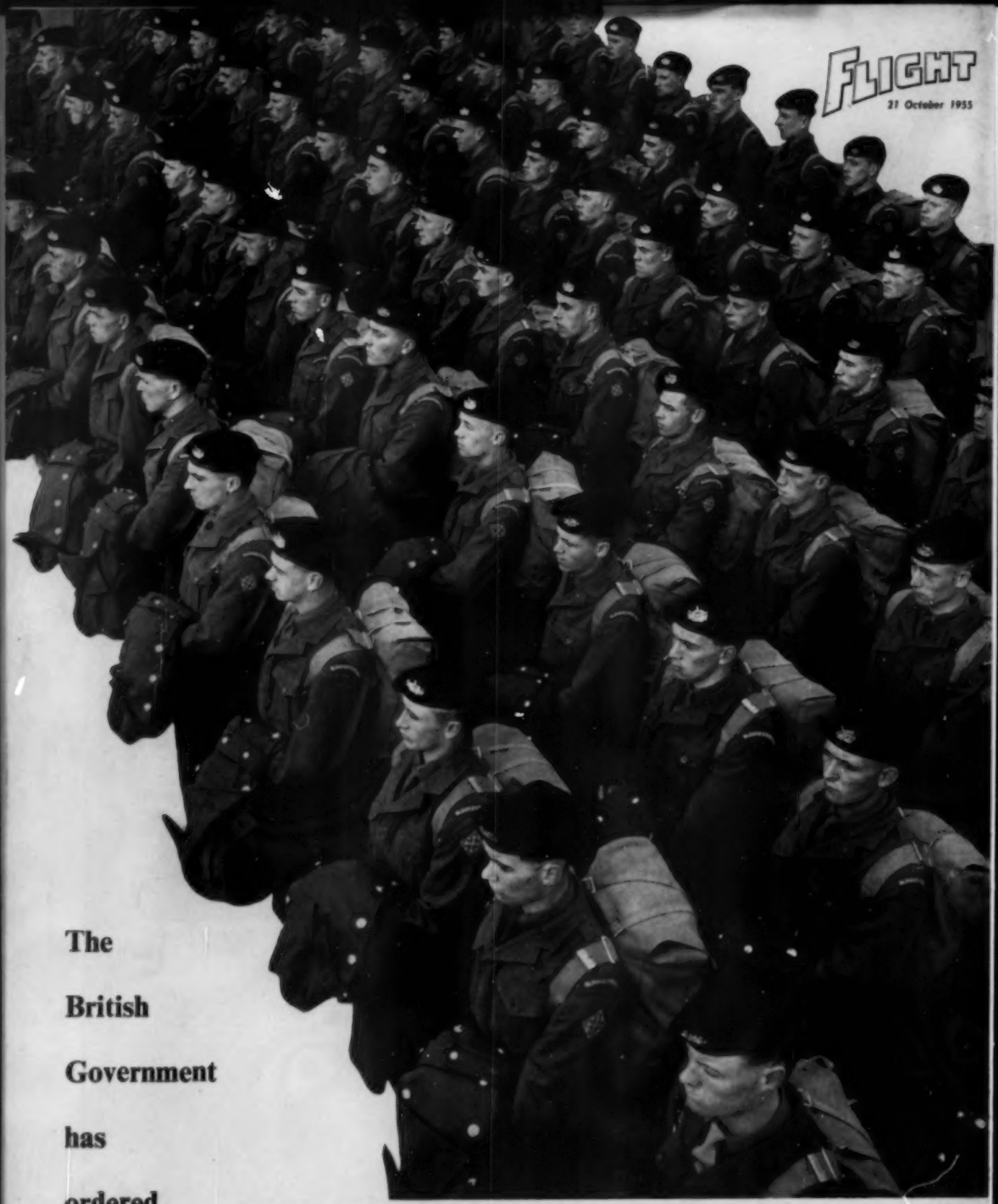

The British Government has ordered Britannias for troop carrying duties

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